# PROJECT MANUAL

LEGACY FARMS

2082 E SPANISH FORK PARKWAY,
SPANISH FORK, UT 84660

501-4029

**THE CHURCH OF**
**JESUS CHRIST**
**OF LATTER-DAY SAINTS**

UNCOMMON ARCHITECTS. 684 W Center St, Midvale, UT 84047

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**END OF SECTION**

# BIDDING REQUIREMENTS

## FIXED SUM PROJECT (U.S.)

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# INVITATION TO BID (U.S.)

**1. GENERAL CONTRACTORS INVITED TO BID THE PROJECT:**

Stone River Construction

Headwaters Construction

Majestic Builders

BC Builders

Menlove Construction

Stallings Construction

Warner Construction

**2. PROJECT:**

Legacy Farms Stake - 501-4029

**3. LOCATION:**

2082 E SPANISH FORK PARKWAY,
SPANISH FORK, UT 84660

**4. OWNER:**

The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole
c/o
(PM/FM office address)

**5. CONSULTANT:**

UNCOMMON ARCHITECTS. 684 W Center St, Midvale, UT 84047

**6. DESCRIPTION OF PROJECT:**

A. New Heritage 24 Stake Center

B. Products or systems may be provided through relationships the Owner has negotiated with suppliers as indicated in the Specifications.

**7. TYPE OF BID:** Bids will be on a lump-sum basis. Segregated bids will not be accepted.

**8. TIME OF SUBSTANTIAL COMPLETION:** The time limit for substantial completion of this work will be 365 calendar days and will be as noted in the Agreement.

**9. BID OPENING:** Bids will be received by Owners preferred method at 1:45PM March 25th, 2026 Bids will be publicly opened at 10:00 AM 03/03/2026 on Conslog..

**10. BIDDING DOCUMENTS:**

A. Bidding Documents may be obtained from the Architect.

B. Bidding Documents may be obtained from Owner's electronic bidding tool.

**11.** **BID BOND:** If required, bid security in the amount of 5 percent (5%) of the bid will accompany each bid in accordance with the Instruction to Bidders.

**12.** **BIDDER'S QUALIFICATIONS:** Bidding by the General Contractors will be by invitation only.

**13.** **OWNER'S RIGHT TO REJECT BIDS:** The Owner reserves the right to reject any or all bids and to waive any irregularity therein.

END OF DOCUMENT

# INSTRUCTIONS TO BIDDERS (U.S.)

**1. DEFINITIONS:**

A. The definitions set forth in Section 1 of the General Conditions are applicable to the documents included under Bidding Requirements.

B. Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The proposed Contract Documents consist of the documents identified as Contract Documents in the Form of Agreement, except for Modifications. The Bidding Requirements are those documents identified as such in the proposed Project Manual.

C. Addenda are written, or graphic documents issued by the Architect prior to execution of the Contract which modify or interpret the Bidding Documents. They become part of the Contract Documents as noted in the Form of Agreement upon execution of the Contract.

**2. BIDDER'S REPRESENTATIONS:**

A. By submitting a bid, the bidder represents that
   1) Bidder has carefully studied and compared the Bidding Documents with each other. Bidder understands the Bidding Documents and the bid is fully in accordance with the requirements of those documents,
   2) Bidder has thoroughly examined the site and any building located thereon, has become familiar with local conditions which might directly or indirectly affect the contract work, and has correlated its personal observations with the requirements of the proposed Contract Documents, and
   3) Bid is based on the materials, equipment, and systems required by the Bidding Documents without exception.

**3. BIDDING DOCUMENTS:**

A. Copies
   1) Bidding Documents may be obtained as set forth in the Invitation to Bid.
   2) Partial sets of Bidding Documents will not be issued.
   3) Bidders will use complete sets of Bidding Documents in preparing bids and make certain that those submitting sub-bids to them have access to all portions of the documents that pertain to the work covered by sub-bid, including General Conditions, Supplementary Conditions, and Division 01. Bidder assumes full responsibility for errors or misinterpretations resulting from use of partial sets of Bidding Documents by itself or any sub-bidder.

B. Interpretation or Correction of Bidding Documents
   1) Bidders will request interpretation or correction of any apparent errors, discrepancies, and omissions in the Bidding Documents.
   2) Corrections or changes to Bidding Documents will be made by written addenda.

C. Substitutions and Equal Products
   1) Generally speaking, substitutions for specified products and systems, as defined in the Uniform Commercial Code, are not acceptable. However, equal products may be approved upon compliance with Contract Document requirements.
   2) The terms *'Acceptable Manufacturers', 'Approved Manufacturers 'Suppliers', Installers'* and *'VMR (Value Managed Relationship) Manufacturers / Suppliers / Installers'* are used throughout the Project Manual to differentiate among the options available to Contractor regarding specified products, manufacturers, and suppliers. See Section 016000 for options available regarding acceptance of equal products.
   3) Base bid only on materials, equipment, systems, suppliers or performance qualities specified in the Bidding Documents.

4) Architect is only authorized to consider requests for approval of equal products to replace specified products in Sections where the heading '*Acceptable Manufacturers*' is used and statement, *'Equal as approved by Architect before bidding. See Section 016000'* or *'Equal as approved by Architect before installation. See Section 016000,'* appears. In Sections where the afore-mentioned statements do not appear and a different heading is used, Architect is authorized as Owner's representative to decline consideration of requests for approval of equal products. Approvals of equal products in such Sections must be made by Owner and will generally be for subsequent Projects.

D. Addenda - Addenda will be sent to bidders and to locations where Bidding Documents are on file no later than 2 business days prior to bid opening.

**4. BIDDING PROCEDURES:**

A. Form and Style of Bids
1) Use Owner's online bidding tool.
2) Fill in all blanks on online bidding tool. Signatures will be executed by representative of bidder duly authorized to make contracts.
3) Bids will bear no information other than that requested on bid form. Do not delete from or add to the information requested on the bid form.

B. Bid Security
1) If required, each bid will be accompanied by a bid bond naming Owner, as listed in the Agreement, as obligee. If Bidder refuses to enter into a Contract or fails to provide bonds and insurance required by the General Conditions, amount of bid security will be forfeited to Owner as liquidated damages, not as a penalty.
2) Bid bond will be issued by a surety company meeting requirements of the General Conditions for surety companies providing bonds and will be submitted on AIA Document A310, Bid Bond or AIA authorized equivalent provided by surety company. The attorney-in-fact who executes the bond on behalf of the surety will affix to the bond a certified and current copy of the power of attorney.
3) Owner may retain bid security of bidders to whom an award is being considered until -
a. Contract has been executed and bonds have been furnished,
b. Specified time has elapsed so bids may be withdrawn, or
c. All bids have been rejected.

C. Submission of Bids
1) Follow the instructions in the Owner's bidding tool when submitting your bid.
2) It is bidder's sole responsibility to see that its bid is received at specified time.
3) No oral, facsimile transmitted, telegraphic, or telephonic bids, modifications, or cancellations will be considered.

D. Modification or Withdrawal of Bid
1) Bidder guarantees there will be no revisions or withdrawal of bid amount for 45 days after bid opening.
2) Prior to bid opening, bidders may withdraw bid from Owner's bidding tool.

**5. CONSIDERATION OF BIDS:**

A. Opening of Bids - See Invitation to Bid.

B. Rejection of Bids - Owner reserves right to reject any or all bids and to waive any irregularity therein.

C. Acceptance of Bid
1) No bidder will consider itself under contract after opening and reading of bids until Agreement between Owner and Contractor is fully executed.
2) Bidder's past performance, organization, subcontractor selection, equipment, and ability to perform and complete its contract in manner and within time specified,

together with amount of bid, will be elements considered in award of contract.

**6. POST-BID INFORMATION:**

A. The conditionally accepted bidder submitting a bid involving subcontractors will submit its list of proposed subcontractors within 24 hours after bid opening.

**7. PERFORMANCE BOND AND PAYMENT BOND:**

A. Bond Requirements - Performance Bond and Labor and Material Payment bond may be required for this Project as specified in the General Conditions.

B. Time of Delivery of Bonds - Bonds will be delivered to Owner with Agreement signed by bidder.

**8. FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR:**

A. Agreement form will be “Agreement Between Owner and Contractor for a Fixed Sum (U.S.)”, “General Conditions Fixed Sum (U.S.)” and “Supplementary Conditions Fixed Sum (U.S.)”.

**9. MISCELLANEOUS:**

A. Pre-Bid Conference
   1) A pre-bid conference will be held at a time and place to be announced.

B. Liquidated Damages - Conditions governing liquidated damages are specified in the General Conditions and in the Supplementary Conditions.

C. Examination Schedule for Existing Building and Site
   1)

D. Exemption from local taxes - See Supplementary Conditions

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# INFORMATION AVAILABLE TO BIDDERS (U.S.)

**1. GEOTECHNICAL DATA**

A. Geotechnical Report -

1) Owner has secured the services of a geotechnical engineer to aid in design of the Project. Following conditions apply -

a) A geotechnical report has been prepared by GSH , referred to as the Geotechnical Engineer.

b) A copy of this report will be issued to each invited Contractor.

c) This report was obtained solely for use in design by Consultant and is not a part of the Contract Documents. It is not intended that Contractor rely on geotechnical engineer's report.

d) Reports are provided for Contractor's information but are not a warranty of subsurface conditions.

2) Prior to bidding, Contractor may make his own subsurface investigations to satisfy himself with site and subsurface conditions.

END OF DOCUMENT

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## SUBCONTRACTORS AND MAJOR MATERIALS SUPPLIERS LIST

Project Name: _____ Date:_____

Stake: _____ Project No: _____

General Contractor: _____

General Contractor is to provide the names of the following subcontractors and suppliers to the Owner's Project Manager immediately following the bid opening:

### VMR SUBCONTRACTORS

Roofing _____

Doors, Frames & Hardware _____

Storefronts _____

Wood Flooring _____

Other _____

Other _____

### SUBCONTRACTORS AND SUPPLIERS

Grading / Site work _____

Site Utilities _____

Demolition _____

Paving _____

Termite Control _____

Site Concrete _____

Fencing _____

Irrigation System _____

Landscaping _____

Building Concrete _____

Masonry _____

Structural Steel _____

Framing _____

Trusses _____

Insulation _____

EIFS _____

Soffit / Fascia _____

Steeple _____

Millwork _____

Drywall _____

Ceramic Tile _____

Acoustical Tile _____

Painting _____

Wall Coverings _____

Elevators / Lifts _____

Draperies _____

Fire Sprinklers _____

Plumbing _____

HVAC _____

Electrical _____

Controls _____

Sound / Satellite _____

# EQUAL PRODUCT APPROVAL REQUEST FORM (U.S.)

Project Name: _____ Request Number: _____

TO: _____

FROM: _____

BID DATE: _____

A proposed product is not legally approved and cannot legally be included in a bid or used in the Work until it appears in an Addendum or other Contract Modification as defined in the General Conditions. See Instructions To Bidders Paragraph 3.C, General Conditions, and Section 016000.

**PROPOSED EQUAL PRODUCT:**

Specification Section: _____

Specified Products: _____

Proposed Product: _____

The Undersigned certifies:

1. Proposed equal product has been fully investigated and determined to be equal or superior in all respects to specified products.
2. Same warranty will be furnished for proposed equal product as for specified products.
3. Same maintenance service and source of replacement parts, as applicable, is available.
4. Proposed equal product will have no adverse effect on other trades and will not affect or delay progress schedule.
5. Proposed equal product does not affect dimensions and functional clearances.

**ATTACHMENTS:**

Include the following attachments -

1. Copy of the Project Manual Section where the proposed equal product would be specified, rewritten or red-lined to include any changes necessary to correctly specify the proposed equal product. Identify completely changes necessary to the original Project Manual Section.
2. Copies of details, elevations, cross-sections, and other elements of the Project Drawings redone as necessary to show changes necessary to accommodate proposed equal product. Identify completely the changes from the original Drawings.
3. Complete product literature and technical data, installation and maintenance instructions, test results, and other information required to show complete conformance with requirements of the Contract Documents.

**SIGNED:** _____

Printed Name _____

Company _____

Address _____

City, State, Zip Code _____

Telephone _____ Fax _____

**REVIEW COMMENTS:**

_____ Accepted. See Addenda Number _____.

_____ Submission not in compliance with instructions. Respond to attached comments and resubmit.

_____ Proposed equal product not acceptable. Use specified products.

_____ Not Reviewed. Submission received too late. Use specified products.

---

**ADDITIONAL COMMENTS:**

---

**BY:** _____ **DATE:** _____

# CONSTRUCTION MATERIAL ASBESTOS STATEMENT (U.S.)

**PROJECTS FOR:**
**THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS,**
**a Utah corporation sole**

Building Name: _____

Building Plan Type: _____

Building Address: _____

Building Owner: The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole.

Project Number: _____

Completion Date: _____

As PROJECT CONSULTANT and principal in charge; based on my best knowledge, information, inspection, and belief; I certify that on the above referenced Project, no asbestos-containing building materials were specified in the construction documents or given approval in shop drawings or submittals.

_____ _____
Project Consultant and Principal in Charge (signature) Date

_____
Company Name

As GENERAL CONTRACTOR in charge of construction; based on my best knowledge, information, inspection, and belief; I affirm that on the above-referenced Project, no asbestos-containing building materials were used in the construction.

_____ _____
General Contractor (signature) Date

_____
Company Name

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# AGREEMENT BETWEEN OWNER AND CONTRACTOR
## FOR A FIXED SUM (U.S.)

The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole ("Owner") and _____ ("Contractor") hereby enter into this *Agreement Between Owner and Contractor for a Fixed Sum (U.S.)* ("Agreement") and agree as follows:

1. **Property/Project.**

   Property/Project Number:
   Property Address ("Project Site"):
   Project Type:
   Project Name ("Project"):
   Stake Name:

2. **Scope of the Work.** Contractor will furnish all labor, materials, equipment, construction, and services necessary to complete the Work in accordance with the Contract Documents.

3. **Contract Documents.**
   a. The Contract Documents consist of:
      1) This Agreement;
      2) The General Conditions for a Fixed Sum (U.S.), the Supplementary Conditions for a Fixed Sum (U.S.), and the Specifications (Divisions 01 through 49) contained in the Project Manual entitled _____, dated _____ and prepared by _____ ("Architect");
      3) The Drawings prepared by Architect entitled _____, sheet numbers _____, dated _____;
      4) Addendum No. _____ dated _____; and
      5) All Modifications to the Contract Documents.
   b. The Contract Documents are incorporated into this Agreement by reference as if fully set forth herein.
   c. The definitions set forth in the General Conditions for a Fixed Sum (U.S.) will apply to the Contract Documents.
   d. The Contract Documents contain the entire and integrated agreement between the parties hereto and supersede all prior negotiations, representations, or agreements, either written or oral.
   e. Modifications or other amendments to the Contract Documents must be in writing and as provided in the General Conditions for a Fixed Sum (U.S.).

4. **Time of Commencement and Substantial Completion.**
   a. Contractor will commence the Work on the date for commencement set forth in the Written Notice to proceed from Owner to Contractor.
   b. Contractor will achieve Substantial Completion and have the Work ready for Owner's inspection no later than _____ (_____) days from the date of commencement set forth in the Written Notice to proceed from Owner to Contractor, as adjusted in accordance with the Contract Documents.
   c. Time is of the essence.

5. **Contract Sum.**
   a. Owner will pay Contractor for performance of Contractor's obligations under the Contract Documents the Contract Sum in the amount of _____ Dollars ($_____), subject to additions and deductions as provided in the Contract Documents.
   b. Owner will make payments to Contractor in accordance with the Contract Documents.

6. **Independent Contractor Relationship.** Contractor is an independent contractor and is not the agent or employee of Owner.

7. **Assignment.** Neither party to this Agreement will assign any right or obligation hereunder without the prior written consent of the other, which consent may be granted or withheld in such party's absolute discretion. Contractor will not assign moneys due or to become due to Contractor hereunder, nor will Contractor pledge the credit of Owner or bind Owner to any third party.

EXAMPLE

8. **Notice.** The parties designate the addresses, facsimile numbers, and email addresses as set forth in the signature blocks below to be used for sending Written Notice to the other party:

9. **Effective Date.** The effective date of this Agreement is the date indicated by the Owner's signature.

| **OWNER:** | **CONTRACTOR:** |
|---|---|
| The Church of Jesus Christ of Latter-day Saints,<br>a Utah corporation sole | (company) |
| Signature: | Signature: |
| Print Name: | Print Name: |
| Title: | Title: |
| Address: | Address: |
| Telephone No: | Telephone No: |
| Facsimile No: | Facsimile No: |
| Email: | Email: |
| Effective Date: | Fed. I.D. or SSN: |
| | License No: |
| Reviewed By: | Date Signed: |

EXAMPLE

# EQUAL PRODUCT APPROVAL REQUEST FORM (U.S.)

Project Name: _____ Request Number: _____

TO: _____

FROM: _____

BID DATE: _____

A proposed product is not legally approved and cannot legally be included in a bid or used in the Work until it appears in an Addendum or other Contract Modification as defined in the General Conditions. See Instructions To Bidders Paragraph 3.C, General Conditions, and Section 016000.

**PROPOSED EQUAL PRODUCT:**

Specification Section: _____

Specified Products: _____

Proposed Product: _____

The Undersigned certifies:

1. Proposed equal product has been fully investigated and determined to be equal or superior in all respects to specified products.
2. Same warranty will be furnished for proposed equal product as for specified products.
3. Same maintenance service and source of replacement parts, as applicable, is available.
4. Proposed equal product will have no adverse effect on other trades and will not affect or delay progress schedule.
5. Proposed equal product does not affect dimensions and functional clearances.

**ATTACHMENTS:**

Include the following attachments -

1. Copy of the Project Manual Section where the proposed equal product would be specified, rewritten or red-lined to include any changes necessary to correctly specify the proposed equal product. Identify completely changes necessary to the original Project Manual Section.
2. Copies of details, elevations, cross-sections, and other elements of the Project Drawings redone as necessary to show changes necessary to accommodate proposed equal product. Identify completely the changes from the original Drawings.
3. Complete product literature and technical data, installation and maintenance instructions, test results, and other information required to show complete conformance with requirements of the Contract Documents.

**SIGNED:** _____

Printed Name _____

Company _____

Address _____

City, State, Zip Code _____

Telephone _____ Fax _____

**REVIEW COMMENTS:**

_____ Accepted. See Addenda Number _____.

_____ Submission not in compliance with instructions. Respond to attached comments and resubmit.

_____ Proposed equal product not acceptable. Use specified products.

_____ Not Reviewed. Submission received too late. Use specified products.

---

**ADDITIONAL COMMENTS:**

---

**BY:** _____ **DATE:** _____

## SUBCONTRACTORS AND MAJOR MATERIALS SUPPLIERS LIST

Project Name: LEGACY FARMS Date: _____

Stake: SPANISH FORK UTAH LEGACY FARMS STAKE Project No: 501-4029

General Contractor: _____

General Contractor is to provide the names of the following subcontractors and suppliers to the Owner's Project Manager immediately following the bid opening:

**VMR SUBCONTRACTORS**

Roofing _____

Doors, Frames & Hardware _____

Storefronts _____

Wood Flooring _____

Other _____

Other _____

**SUBCONTRACTORS AND SUPPLIERS**

Grading / Site work _____

Site Utilities _____

Demolition _____

Paving _____

Termite Control _____

Site Concrete _____

Fencing _____

Irrigation System _____

Landscaping _____

Building Concrete _____

Masonry _____

Structural Steel _____

Framing _____

Trusses _____

Insulation _____

EIFS _____

Soffit / Fascia _____

Steeple _____

Millwork _____

Drywall _____

Ceramic Tile _____

Acoustical Tile _____

Painting _____

Wall Coverings _____

Elevators / Lifts _____

Draperies _____

Fire Sprinklers _____

Plumbing _____

HVAC _____

Electrical _____

Controls _____

Sound / Satellite _____

# GENERAL CONDITIONS
## For a Fixed Sum (U.S.)

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## SECTION 1 - GENERAL PROVISIONS

### 1.1 DEFINITIONS

A. Adverse Weather: weather conditions that are seasonally abnormal and could not have been reasonably anticipated.

B. Agreement: the document entitled "Agreement Between Owner and Contractor for a Fixed Sum (U.S.), executed by Owner and Contractor for performance of the Work.

C. Architect: the entity identified as such in the Agreement.

D. Change In The Work: a modification to the requirements of the Contract Documents or a delay in Substantial Completion resulting from an instruction from Owner or Architect to Contractor or from another event or circumstance.

E. Change Order: a written instrument prepared by Architect and signed by Owner, Contractor, and Architect stating their agreement upon the following: (1) the occurrence of a Change in the Work; (2) the amount of the adjustment, if any, in the Contract Sum as a result of the Change in the Work; and (3) the extent of the adjustment, if any, in the Contract Time as a result of the Change in the Work.

F. Construction Change Directive: a written order prepared by Architect and signed by Architect and Owner which: (1) orders a Change in the Work if the terms of a Change Order cannot be agreed upon prior to performance of a Change in the Work described in Section 7.1 or after occurrence of an event or circumstance described in Section 7.2; and (2) states a proposed basis for adjustment, if any, in the Contract Sum, the Contract Time, or both, resulting from the Change in the Work.

G. Contract Documents: the documents identified as such in the Agreement.

H. Contract Sum: the total amount set forth in the Agreement payable by Owner to Contractor for performance of the Work.

I. Contract Time: the period of time set forth in the Agreement for the Substantial Completion of the Work.

J. Contractor: the entity identified as such in the Agreement.

K. Day: calendar day unless otherwise specifically defined.

L. Direct Costs: actual costs for labor, materials, equipment, insurance, bonds, subcontract costs and onsite supervision relating to the Project. They do not include labor costs for project managers or other off-site administration.

M. Drawings: the documents identified as such in the Agreement.

N. Field Change: a written order prepared by Architect and signed by Architect and Contractor for a minor Change in the Work consistent with the general intent of the Contract Documents costing $1,000 or less, resulting in no time extension, and which is necessary to avoid delaying the Work.

O. Modification: a written amendment to the Contract Documents in the form of a:
1. Change Order;
2. Construction Change Directive; or
3. Field Change.

P. Owner: the entity identified as such in the Agreement.

Q. Project: the total construction designed by Architect of which the Work performed under the Contract Documents may be the whole or a part.

R. Product Data: standard illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate details regarding materials or equipment to be used in the Work, or the manner of installation, operation, or maintenance of such materials or equipment.

S. Project Manual: the document identified as such in the Agreement.

T. Samples And Mock-ups: physical examples that illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

U. Shop Drawings: drawings, diagrams, illustrations, schedules, performance charts, fabrication and installation drawings, setting diagrams, patterns, templates, and other data which illustrate some portion of the Work and confirm dimensions and conformance to the Contract Documents specially prepared by Contractor or any Subcontractor, manufacturer, supplier, or distributor.

V. Specifications: the documents identified as such in the Agreement.

W. Subcontractor: any entity supplying labor, materials, equipment, construction or services for the Work under separate contract with Contractor or any other Subcontractor.

X, Submittals: Shop Drawings, Product Data, Samples and Mock-ups and any other documents or items furnished by Contractor or its Subcontractors to Owner or Architect to demonstrate how any portion of the Work will be accomplished or the type of materials or products that will be used in the Work.

Y. Substantial Completion: Completion of the Work to a point where Owner can use the Work for its intended purposes. The date of Substantial Completion is the date certified as such by Architect in accordance with the Contract Documents.

Z. Work: all labor, materials, equipment, construction, and services required by the Contract Documents.

AA. Written Notice: notice in writing given from one party to the other at the addresses or facsimile numbers listed in the Agreement, or at such other addresses or facsimile numbers as the parties will designate from time to time by Written Notice, and will be effective at the earliest of:
1. The date of personal delivery to the other party with signed acknowledgment of receipt; or
2. The date sent by facsimile transmission to the other party provided receipt of the facsimile is verified by an electronic confirmation report by the party sending the facsimile transmission and further provided that a confirmation copy is sent to the other party by courier or by registered or certified mail within twenty-four (24) hours after the time and date of the facsimile transmission; or
3. The date of receipt by the other party as stated on the return receipt if sent by registered or certified mail, or by courier.

**1.2 CORRELATION AND INTENT OF CONTRACT DOCUMENTS**

A. The intent of the Contract Documents is to require Contractor to provide all labor, materials, equipment, construction, and services necessary for the proper execution and completion of the Work. The Contract Documents are complementary and what is required by any one will be as binding as if required by all. Contractor will perform the Work in accordance with the requirements expressly set forth in or reasonably inferable from the Contract Documents.

B. The organization of the Contract Documents is not intended to control Contractor in dividing the Work among Subcontractors or to establish the extent of the Work to be performed by any trade.

C. Words used in the Contract Documents that have well known technical or trade meanings are used therein in accordance with such recognized meanings.

D. In the interest of brevity, the Contract Documents may 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.

**1.3 OWNERSHIP AND USE OF CONTRACT DOCUMENTS**

The Drawings, the Project Manual, and copies thereof are the property of Owner. Contractor will not use these documents on any other project. Contractor may retain one copy of the Drawings and the Project Manual as a contract record set and will return or destroy all remaining copies following final completion of the Work.

**1.4 PUBLIC STATEMENTS REGARDING PROJECT**

Contractor will not make any statements or provide any information to the media about the Project without the prior written consent of Owner. If Contractor receives any requests for information from media, Contractor will refer such requests to Owner.

**1.5 OWNERSHIP AND USE OF RENDERINGS AND PHOTOGRAPHS**

Renderings representing the Work are the property of Owner. All photographs of the Work, whether taken during performance of the

Work or at completion, are the property of the Owner. The Owner reserves all rights including copyrights to renderings and photographs of the Work. No renderings or photographs shall be used or distributed without written consent of the Owner

### 1.6 NO COMMERCIAL USE OF TRANSACTION OR RELATIONSHIP

Without the prior written consent of Owner, which Owner may grant or withhold in its sole discretion, neither Contractor nor Contractor's affiliates, officers, directors, agents, representatives, shareholders, members, Subcontractors, Sub-subcontractors or employees shall make any private commercial use of their relationship to Owner or the Project, including, without limitation:

A. By referring to this Agreement, Owner, or the Project verbally or in any sales, marketing or other literature, letters, client lists, press releases, brochures or other written materials except as may be necessary for Contractor to perform Contractor's obligations under the terms of this Agreement;

B. By using or allowing the use of any photographs of the Project or any part thereof, or of any service marks, trademarks or trade names or other intellectual property now or which may hereafter be associated with, owned by or licensed by Owner in connection with any service or product; or

C. By contracting with or receiving money or anything of value from any person or commercial entity to facilitate such person or entity obtaining any type of commercial identification, advertising or visibility in connection with the Project.

Notwithstanding the foregoing, Contractor may include a reference to Owner and the services and equipment provided under this Agreement in a professional résumé or other similar listing of Contractor's references without seeking Owner's written consent in each instance; provided, that such reference to Owner, the services and equipment is included with at least several other similar references and is given no more prominence than such other references.

### 1.7 CONFIDENTIALITY / PROPERTY RIGHTS

A. Owner will retain ownership and intellectual property rights in all plans, designs, drawings, documents, concepts, and materials provided by or on behalf of Owner to Contractor and to all work products of Contractor for or relative to Work performed under this Agreement, such products, services, and Work of Contractor constituting works made for hire. Contractor will not reuse any portions of such items provided by Owner or developed by Contractor for Owner pursuant to this Agreement, or disclose any such items to any third party without the prior written consent of Owner. Owner may withhold its consent in its' absolute discretion.

B. In addition, Contractor shall ensure that Contractor, Subcontractors, and the employees, agents and representatives of Contractor and its Subcontractors maintain in strict confidence, and shall use and disclose only as authorized by Owner all Confidential Information of Owner that Contractor receives in connection with the performance of this Agreement. Notwithstanding the foregoing, Contractor may use and disclose any information to the extent required by an order of any court or governmental authority, but only after it has notified Owner and Owner has had an opportunity to obtain reasonable protection for such information in connection with such disclosure. For purposes of this Agreement, "Confidential Information" means:
   1. The name or address of any affiliate, customer or contractor of Owner or any information concerning the transactions of any such person with Owner;
   2. Any information relating to contracts, agreements, business plans, budgets or other financial information of Owner to the extent such information has not been made available to the public by the Owner; and
   3. Any other information that is marked or noted as confidential by the Owner at the time of its disclosure.

### 1.8 COMPLY WITH INTELLECTUAL PROPERTY RIGHTS OF OTHERS

Contractor represents and warrants that no Work (with its means, methods, goods, and services attendant thereto), provided to Owner will infringe or violate any right of any third party and that Owner may use and exploit such Work, means, methods, goods, and services without liability or obligation to any person or entity (specifically and without limitation, such Work, means, methods, goods, and services will not violate rights under any patent, copyright, trademark, or other intellectual property right or application for the same).

## SECTION 2 - OWNER

### 2.1 OWNER'S DESIGNATED REPRESENTATIVE

Owner will designate in writing a representative who will have express authority to bind Owner with respect to all matters requiring Owner's approval or authorization.

### 2.2 INFORMATION AND SERVICES REQUIRED OF OWNER

A. Owner will be responsible for establishment of property lines and benchmarks for grading.

B. Owner will furnish to Contractor any information or services it is required to furnish under the Contract Documents with reasonable promptness to avoid delay in the orderly progress of the Work.

C. Owner will furnish to Contractor a reasonable number of copies of the Drawings, the Project Manual, and the Addenda.

### 2.3 OWNER'S RIGHT TO INSPECT THE WORK

Owner and its representatives will have the right to inspect any portion of the Work wherever located at any time.

### 2.4 OWNER'S RIGHT TO STOP THE WORK

If Contractor fails to carry out the Work in accordance with the Contract Documents or fails to correct Work which is not in accordance with the Contract Documents in a timely manner, Owner may order Contractor in writing to stop the Work, or any portion thereof, until the cause for that order has been eliminated.

## SECTION 3 - CONTRACTOR

### 3.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

A. By executing the Agreement, Contractor represents that it has visited the Project site, familiarized itself with the local conditions under which the Work is to be performed, and correlated its own observations with the requirements of the Contract Documents.

B. Contractor will carefully review and compare the Contract Documents and any other available information relating to the Project prior to commencing and during performance of each portion of the Work and will immediately report to Architect any errors, inconsistencies, and omissions it discovers.

C. Should Contractor or any of its Subcontractors become aware of any question regarding the meaning or intent of any part of the Contract Documents prior to commencing that portion of the Work about which there is a question, Contractor will request an interpretation or clarification from Architect before proceeding. Contractor proceeds at its own risk if it proceeds with the Work without first making such a request and receiving an interpretation or clarification from Architect. If neither Contractor nor its Subcontractors become aware of the question until after work on the relevant portion of the Work has commenced, then the following precedence will govern for purposes of determining whether resolution of the question constitutes a Change in the Work:
   1. The Agreement takes precedence over all other Contract Documents.
   2. The Supplementary Conditions take precedence over the General Conditions.
   3. The General Conditions and Supplementary Conditions take precedence over the Drawings and the Specifications.
   4. An Addendum or a Modification takes precedence over the document(s) modified by the Addendum or Modification.
   5. The Specifications take precedence over the Drawings.
   6. Within the Drawings, larger scale drawings take precedence over smaller scale drawings, figured dimensions over scaled dimensions, and noted materials over graphic indications.

D. Contractor will give Architect notice of any additional drawings, specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work, sufficiently in advance of the need for information so as not to delay the Work.

E. It is not Contractor's responsibility to ascertain that the Contract Documents are in accordance with requirements of applicable laws, statutes, ordinances, building codes, rules and regulations. However, if Contractor observes that portions of the Contract Documents are at variance with those requirements, Contractor will immediately notify Architect in writing. Contractor will not proceed unless Owner and/or Architect effects Modifications to the Contract Documents required for compliance with such requirements. Contractor will be fully responsible for any work knowingly performed contrary to such requirements and will fully indemnify Owner against loss and bear all costs and penalties arising therefrom.

F. Contractor will take field measurements and verify field conditions and will compare such field measurements and conditions and other information known to Contractor with the Contract Documents before ordering any materials or commencing construction activities. Contractor will immediately report errors, inconsistencies, and omissions that it discovers to Architect. If Contractor orders materials or commences construction activities before taking field measurements and verifying field conditions, Contractor will not be entitled to any compensation for additional costs to Contractor resulting from field measurements or conditions different from those anticipated by Contractor which would have been avoided had Contractor taken field measurements and verified field conditions prior to ordering the materials or commencing construction activities.

G. If site conditions indicated in the Contract Documents or other information provided by Owner or Architect to Contractor differ materially from those Contractor encounters in performance of the Work, Contractor will immediately notify Architect in writing of such differing site conditions.

H. Where the Contract Documents require the Contractor to provide professional services for architecture or engineering, the Contractor shall cause such services to be performed by appropriately licensed professionals.

### 3.2 SUPERVISION OF CONSTRUCTION PROCEDURES

A. Contractor will supervise and direct the Work. Contractor will be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work. All loss, damage, liability, or cost of correcting defective work arising from the use of any construction means, methods, techniques, sequences or procedures will be borne by Contractor, notwithstanding that such construction means, methods, techniques, sequences or procedures are referred to, indicated or implied by the Contract Documents, unless Contractor has given timely notice to Owner and Architect in writing that such means, methods, techniques, sequences or procedures are not safe or suitable, and Owner has then instructed Contractor in writing to proceed at Owner’s risk.

B. Contractor will utilize its best skill, efforts, and judgment to provide efficient business administration and supervision, to furnish at all times an adequate supply of workers and materials, and to perform the Work in an expeditious and economical manner consistent with the interests of Owner.

C. Contractor will be responsible for:
   1. The proper observance of property lines and set back requirements as shown in the Contract Documents;
   2. The location and layout of the Work as shown in the Contract Documents with respect to the position of the Work on the property and the elevation of the Work in relation to grade; and
   3. Setting and maintaining construction stakes.

D. Contractor will be responsible to Owner for the acts and omissions of its employees and Subcontractors as well as persons either directly or indirectly employed by Subcontractors.

E. Contractor will not be relieved of its obligation to perform the Work in accordance with the Contract Documents as a result of any tests, inspections, or approvals by Owner, Architect or their consultants.

F. Contractor will be responsible for inspection of portions of the Work already completed to determine that such portions are in proper condition to receive subsequent portions of the Work.

G. Contractor recognizes that the Project site and the surrounding area is frequently visited by the public and is important to Owner's image and function and will maintain the premises free from debris and waste materials resulting from Construction. At the completion of Construction, Contractor shall promptly remove construction equipment, tools, surplus materials, waste materials and debris.

**3.3 LABOR AND MATERIALS**

A. Unless otherwise provided in the Contract Documents, Contractor will provide and pay for all labor, materials, equipment, tools, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work.

B. Contractor will at all times enforce strict discipline and good order among those performing the Work and will not permit employment of any unfit person or anyone not skilled in the tasks assigned to them.

C. Contractor is fully responsible for the Project and all materials and work connected therewith until Owner has accepted the Work in writing. Contractor will replace or repair at its own expense any materials or work damaged or stolen, regardless of whether it has received payment for such work or materials from the Owner.

D. Contractor will remedy all damage or loss to any property caused in whole or in part by Contractor, any Subcontractor, or by anyone for whose acts any of them may be liable.

E. Contractor will be responsible for determining that all materials furnished for the Work meet all requirements of the Contract Documents. Architect may require Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports of past tests by qualified testing laboratories, reports of studies by qualified experts, or other evidence which, in the opinion of Architect, would lead to a reasonable certainty that any material used, or proposed to be used, in the work meets the requirements of the Contract Documents. All such data will be furnished at Contractor's expense. This provision will not require Contractor to pay for periodic testing of different batches of the same material, unless such testing is specifically required by the Contract Documents to be performed at Contractor's expense.

F. Contractor will coordinate and supervise the work performed by Subcontractors so that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the Work. Contractor and all Subcontractors will at all times afford each trade, any separate contractor, or Owner, reasonable opportunity for the installation of Work and the storage of materials.

G. Contractor warrants to Owner that the materials and equipment furnished for the Work will be new unless otherwise specified by the Contract Documents, and that the Work will be free from defects, and will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective in the discretion of Owner. If required by Architect, Contractor will furnish satisfactory evidence as to the kind and quality of the materials and equipment used in performing the Work.

H. Owner may elect to purchase materials required for the Work. In that event, Contractor will comply with the procedures set forth in the Contract Documents relating to such materials.

**3.4 COMPLIANCE WITH LAWS**

Contractor will comply with all applicable laws, ordinances, rules, regulations, and orders of any public authorities relating to performance of the Work.

**3.5 TAXES**

A. Contractor will pay all sales, use, consumer, payroll, workers compensation, unemployment, old age pension, surtax, and similar taxes assessed in connection with the performance of the Work.

B. Owner will pay all taxes and assessments on the real property comprising the Project site.

**3.6 PERMITS AND FEES**

A. Owner will obtain and pay for all zoning and use permits and permanent easements necessary for completion of the Work.

B. Contractor will obtain and pay for the building permit, and all other permits, governmental fees, licenses and inspections necessary for the proper execution and completion of the Work.

C. Contractor will secure any certificates of inspection and of occupancy required by authorities having jurisdiction over the Work. Contractor will deliver these certificates to Architect prior to issuance of the Certificate of Substantial Completion by Architect.

**3.7 CONTRACTOR'S ON-SITE REPRESENTATIVE**

Contractor will employ a competent representative acceptable to Owner to supervise the performance of the Work. This representative will be designated in writing by Contractor prior to commencement of work and will not be changed prior to final inspection of the Work without prior written consent of Owner. This representative will represent Contractor for all purposes, including communication with Owner.

**3.8 CONTRACTOR'S CONSTRUCTION SCHEDULES**

A. Contractor will prepare and submit for Owner's and Architect's information Contractor's construction schedule for the Work in accordance with the requirements of the Contract Documents.

B. Contractor will prepare and maintain a Submittal schedule which is coordinated with Contractor's construction schedule and sets forth specified times for Architect to review Submittals.

**3.9 DOCUMENTS AND SUBMITTALS AT THE SITE**

Contractor will keep at the Project site for use by Owner, Architect, or their representatives, a record copy of the Project Manual, the Drawings, all Addenda, and all Modifications. These documents will be maintained in good order and currently marked to record changes and selections made during construction. In addition, Contractor will keep at the Project site one copy of all Submittals.

**3.10 SUBMITTALS**

A. Submittals are not Contract Documents and do not alter the requirements of the Contract Documents unless incorporated into the Contract Documents by a Modification.

B. Contractor will review, approve, and submit to Architect Submittals in accordance with the Contract Documents. By approving Submittals, Contractor represents that it has determined and verified field measurements, field construction criteria, materials, catalog numbers, and similar data, and that it has checked and coordinated each Submittal with the requirements of the Work and of the Contract Documents or will make such determination, verification, check, and coordination prior to commencing the relevant portion of the Work. In reviewing Submittals Architect will be entitled to rely upon Contractor’s representation that such information is correct and accurate.

C. Contractor will inform Architect in writing at the time of submission of any Submittal or portion thereof which deviates from the requirements of the Contract Documents. Contractor will provide Architect with documentation demonstrating to Architect that the Submittal is equal to or better than the specified product or work. Contractor will not be relieved of responsibility for deviations from the requirements of the Contract Documents by Architect’s acceptance of a Submittal unless Contractor has informed Architect in writing of the deviation and Architect has incorporated the deviation into the Contract Documents by a Modification.

D. Contractor will not perform any portions of the Work requiring Submittals until the respective Submittal has been reviewed and accepted in writing by Architect.

E. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, Owner will be entitled to rely upon such certifications, and neither Owner nor Architect will be expected to make any independent examination with respect thereto.

F. Submittals not required by the Contract Documents may be returned to Contractor without action.

**3.11 CUTTING AND PATCHING**

Contractor will be responsible for any cutting, fitting, and patching that may be required to complete the Work and make its parts fit together properly.

**3.12 ACCESS TO WORK**

Contractor will permit Owner, Architect, their representatives and consultants, access to the Work wherever located at any time.

**3.13 ROYALTIES AND PATENTS**

Contractor will pay all royalties and license fees required by the Work or by Contractor's chosen method of performing the Work. Contractor will defend and hold Owner harmless from all suits or claims for infringement of any patent, license or other intellectual property rights or any loss on account thereof.

### 3.14 INDEMNIFICATION

A. Contractor will indemnify and hold harmless Owner and Owner's representatives, employees, agents, architects, and consultants from and against any and all claims, damages, liability, demands, costs, judgments, awards, settlements, causes of action, losses and expenses (collectively “Claims” or “Claim”), including but not limited to attorney fees, consultant fees, expert fees, copy costs, and other expenses, arising out of or resulting from performance of the Work, attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of real or personal property, including loss of use resulting therefrom, except to the extent that such liability arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity includes, without limitation, indemnification of Owner from all losses or injury to Owner’s property, except to the extent that such loss or injury arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity applies, without limitation, to include Claims occurring both during performance of the Work and/or subsequent to completion of the Work. In the event that any Claim is caused in part by a party indemnified hereunder, that party will bear the cost of such Claim to the extent it was the cause thereof. In the event that a claimant asserts a Claim for recovery against any party indemnified hereunder, the party indemnified hereunder may tender the defense of such Claim to Contractor. If Contractor rejects such tender of defense and it is later determined that the negligence of the party indemnified hereunder did not cause all of the Claim, Contractor will reimburse the party indemnified hereunder for all costs and expenses incurred by that party in defending against the Claim. Contractor will not be liable hereunder to indemnify any party for damages resulting from the sole negligence of that party.

B. In addition to the foregoing, Contractor will be liable to defend Owner in any lawsuit filed by any Subcontractor relating to the Project. Where liens have been filed against Owner's property, Contractor (and/or its bonding company which has issued bonds for the Project) will obtain lien releases and record them in the appropriate county and/or local jurisdiction and provide Owner with a title free and clear from any liens of Subcontractors. In the event that Contractor and/or its bonding company are unable to obtain a lien release, Owner in its absolute discretion may require Contractor to provide a bond around the lien or a bond to discharge the lien, at Contractor's sole expense.

C. In addition to the foregoing, Contractor will indemnify and hold Owner harmless from any claim of any other contractor resulting from the performance, nonperformance or delay in performance of the Work by Contractor.

D. The indemnification obligation herein will not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or a Subcontractor under worker's compensation acts, disability benefit acts, or other employee benefit acts.

### 3.15 PROJECT MEETINGS

Contractor will attend and participate in meetings as required by the Contract Documents.

## SECTION 4 - ADMINISTRATION OF THE CONTRACT

### 4.1 ARCHITECT

In the event that Owner terminates its contractual relationship with Architect, Owner will appoint in writing another architect, whose status under the Contract Documents will be that of the former Architect in all respects.

### 4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

A. Architect will make periodic visits to the site to familiarize itself generally with the progress and quality of the Work and to determine if the Work is proceeding in accordance with the Contract Documents. Although Architect is required to make periodic inspections, it is not required to make exhaustive or continuous onsite inspections. On the basis of its observations while at the site, Architect will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defects and deficiencies in the Work. Architect’s failure to observe a defect or deficiency in the Work will not relieve Contractor of its duty to perform the Work in accordance with the Contract Documents.

B. Architect will review Contractor's payment requests and determine the amounts due Contractor in accordance with Section 9.

C. Communications between Contractor and Owner relating to the Work will be through Architect. Communications between Owner or Contractor with Architect’s consultants relating to the Work will be through Architect. Communications between Owner or Architect and subcontractors relating to the Work will be through Contractor. Communications between Contractor and any separate contractor will be through Architect, except as otherwise specified in the Contract Documents.

D. Owner and/or Architect will have the right to reject and require removal of the following at Contractor's expense:
   1. Any portion of the Work that does not meet the requirements of the Contract Documents.
   2. Any portion of the Work damaged or rendered unsuitable during installation or resulting from failure to exercise proper protection.

E. Architect will have authority to suspend the Work, with concurrence of Owner, whenever such suspension may be necessary in its reasonable opinion to insure the proper performance of the Work.

F. Architect will review Contractor’s Submittals and will accept or take other appropriate action regarding the Submittals. Architect's review of the Submittals will be for the limited purpose of checking for general conformance with the Contract Documents and will not be conducted for the purpose of determining the accuracy and completeness of details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which

remain the responsibility of Contractor. Architect's review of Submittals will not relieve Contractor of its obligations under the Contract Documents. Architect's review of Submittals will not constitute acceptance of safety precautions or construction means, methods, techniques, sequences or procedures. Architect's acceptance of a specific item will not indicate acceptance of an assembly of which the item is a component.

G. Architect has authority to order Construction Change Directives and Field Changes in accordance with Section 7.

H. Architect will conduct inspections to determine the dates of Substantial Completion and final completion, will receive and review written guarantees and related documents required by the Contract and assembled by Contractor, and will review and certify or reject Contractor's final payment request.

I. Architect will be the interpreter of the performance and requirements of the Contract Documents. Architect's interpretations will be in writing or in the form of drawings.

J. Architect's decisions in matters relating to aesthetic effect will be final if consistent with the Contract Documents and approved by Owner.

## SECTION 5 - SUBCONTRACTORS

### 5.1 AWARD OF SUBCONTRACTS FOR PORTIONS OF THE WORK

A. Contractor will enter into contracts with Subcontractors to perform all portions of the Work that Contractor does not customarily perform with its own employees.

B. Contractor will not contract with any Subcontractor who has been rejected by Owner. Contractor will not be required to contract with any Subcontractor against whom it has a reasonable objection.

C. If Owner rejects any Subcontractor proposed by Contractor, Contractor will propose an acceptable substitute to whom Owner has no reasonable objection.

D. Contractor will not make any substitution for any Subcontractor that has been accepted by Owner and Architect without the prior written approval of Owner and Architect.

### 5.2 SUBCONTRACTUAL RELATIONS

A. Contractor's responsibility for the Work includes the labor and materials of all Subcontractors, including those recommended or approved by Owner. Contractor will be responsible to Owner for proper completion and guarantee of all workmanship and materials under any subcontracts. Any warranties required for such work will be obtained by Contractor in favor of Owner and delivered to Architect. It is expressly understood and agreed that there is no contractual relationship between Owner and any Subcontractor, and under no circumstances will Owner be responsible for the non-performance or financial failure of any Subcontractor or any effects therefrom.

B. Contractor agrees to pay the Subcontractors promptly upon receipt of payment from Owner for that portion of the funds received which represents the Subcontractor's portion of the Work completed to Contractor's satisfaction for which Owner has made payment.

C. Contractor will require each Subcontractor to:
1. Be licensed by the state in which the Project is located where such licensing is required by the governing authority;
2. Be bound by the terms of the Contract Documents as far as they are applicable to the Subcontractor's work;
3. Assume toward Contractor the same obligations Contractor has assumed toward Owner, including the prompt payment of its Subcontractors;
4. Submit its applications for payment to Contractor in time to permit Contractor to make timely application to Owner;
5. Execute claim or lien releases or lien waivers for payments made by Contractor; and
6. Make all claims for Changes in the Work to Contractor in the same manner as Contractor is required to make such claims to Owner.

## SECTION 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

### 6.1 OWNER'S RIGHT TO PERFORM WORK OR AWARD SEPARATE CONTRACTS

A. Owner reserves the right to perform work itself or to award separate contracts in connection with the Project.

B. When separate contracts are awarded, "Contractor" in the Contract Documents in each case will mean the contractor who signs each separate contract.

### 6.2 MUTUAL RESPONSIBILITY

A. Contractor will afford other contractors reasonable opportunity to place and store their materials and equipment on site and to perform their work and will properly connect and coordinate its Work with theirs where applicable.

B. If any part of Contractor's Work depends upon the work of any separate contractor for proper performance or results, Contractor will inspect and promptly report to Architect any apparent discrepancies or defects in such work that render it unsuitable for proper performance and results. Failure of Contractor to so inspect and report will constitute an acceptance of the work of the separate contractor as fit and proper to receive Contractor's Work, except as to defects not then reasonably discoverable.

C. Contractor will promptly remedy damage caused by Contractor or any Subcontractor to the completed or partially completed work of other contractors or to the property of Owner or other contractors.

### 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among Contractor and separate contractors as to the responsibility under their separate contracts for maintaining the Project free from waste materials and rubbish, Owner may clean the Project, allocate the cost among those responsible as Owner and Architect determine to be just, and withhold such cost from any amounts due or to become due to Contractor.

## SECTION 7 - CHANGES IN THE WORK

### 7.1 CHANGES IN THE WORK RESULTING FROM AN INSTRUCTION BY OWNER OR ARCHITECT TO CONTRACTOR

A. If Owner or Architect gives Contractor an instruction that modifies the requirements of the Contract Documents or delays Substantial Completion, Contractor may be entitled to an adjustment in the Contract Sum and/or the Contract Time. If compliance with the instruction affects the cost to Contractor to perform the Work, the Contract Sum will be adjusted to reflect the reasonable increase or decrease in cost subject to the conditions set forth in Section 7.1, Paragraphs B through G. If compliance with the instruction delays Substantial Completion, the Contract Time will be extended for a period of time commensurate with such delay subject to the conditions set forth in Section 7.1, Paragraphs B through G and Section 7.3, Paragraph A and Contractor will be paid liquidated damages for the delay as set forth in Section 7.3, Paragraph B.

B. If Contractor receives an instruction from Owner or Architect that Contractor considers to be a Change in the Work, Contractor, before complying with the instruction, will notify Architect in writing that Contractor considers such instruction to constitute a Change in the Work. If Architect agrees that compliance with the instruction will constitute a Change in the Work, Contractor will furnish a proposal for a Modification in accordance with Section 7.1, Paragraphs C. and D. within ten (10) days.

C. If Contractor claims that it is entitled to an adjustment in the Contract Sum (including without limitation costs related to a time extension) as a result of an instruction by Owner or Architect, Contractor will furnish a proposal for a Change Order containing a price breakdown itemized as required by Owner. The breakdown will be in sufficient detail to allow Owner to determine any increase or decrease in Direct Costs as a result of compliance with the instruction. Any amount claimed for subcontracts will be supported by a similar price breakdown and will itemize the Subcontractor's profit and overhead charges. Profit and overhead will be subject to the following limitations:
   1. The Subcontractor's profit and overhead will not exceed ten (10) percent of its Direct Costs on work performed. Subcontractor's profit and overhead will not exceed five (5) percent on work performed by its sub-subcontractors.
   2. Contractor's profit and overhead on work performed by its own crews will not exceed ten (10) percent of its Direct Costs.
   3. Contractor's profit and overhead mark up on work performed by its Subcontractors will not exceed five (5) percent of the Subcontractors' charges for such work.
   4. Amounts due Owner as a result of a credit change will be the actual net savings to Contractor from the Change in the Work as confirmed by Architect. On credit changes, profit and overhead on the originally estimated work will not be credited back to Owner. If both additions and credits are involved in a single Change in the Work, overhead and profit will be figured on the basis of net increase, if any, related to that Change in the Work.

D. If Contractor claims that it is entitled to an adjustment in the Contract Time as a result of an instruction from Owner or Architect, Contractor will include in its proposal justification to support Contractor's claim that compliance with the instruction will delay Substantial Completion.

E. Upon receipt of Contractor's proposal for Modification, Architect and Owner will determine whether to proceed with the Change in the Work. If Architect and Owner determine to proceed with the Change in the Work, they will issue a Change Order, a Construction Change Directive or a Field Change as appropriate.

F. Contractor agrees that if it complies with an instruction from Owner or Architect without first giving written notice to Architect as provided in Section 7.1., Paragraph B, and receiving a Change Order, Construction Change Directive or Field Change, Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time as a result of the instruction and waives any claim therefor.

G. If Contractor is instructed to perform work which it claims constitutes a Change in the Work but which Owner and Architect do not agree constitutes a Change in the Work, Contractor will comply with the instruction. Contractor may submit its claim for adjustment to the Contract Sum, the Contract Time, or both as a dispute pursuant to Section 13 within thirty (30) days after compliance with the instruction. Contractor agrees that if it fails to submit its claim for resolution pursuant to Section 13 within thirty (30) days after compliance with the instruction, then Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time as a result of the instruction and waives any claim therefor.

H. Contractor agrees that it is responsible for submitting accurate cost and pricing data to support its Change Order Proposals. Owner will have the right to examine the Contractor's records to verify the accuracy and appropriateness of the pricing data used to price change order proposals.

### 7.2 CHANGE IN THE WORK RESULTING FROM AN EVENT OR CIRCUMSTANCE

A. If an event or circumstance other than an instruction from Owner or Architect affects the cost to Contractor of performing the Work or delays Substantial Completion, Contractor may be entitled to an adjustment in the Contract Sum and/or the Contract Time. If the circumstance or event affects the cost to Contractor to perform the Work and is caused by a willful or negligent act or omission of Owner or Architect, the Contract Sum will be adjusted to reflect the reasonable increase or decrease in Contractor's cost to perform the Work resulting from the event or circumstance, subject to the conditions set forth in Section 7.2, Paragraphs B through F. If the event or circumstance delays Substantial Completion and is described in Section 7.3, Paragraph A, the Contract Time will be extended for a period of time commensurate with such delay subject to the conditions set forth in such section. If the circumstance or event delays Substantial Completion and is caused by a willful or negligent act or omission of Owner or Architect, then Contractor will be compensated for costs incident to the delay in accordance with Section 7.3, Paragraph B. Contractor will not be entitled to any adjustment to the Contract Sum or other damages from Owner as a result of any event or circumstance unless the event or circumstance results from a willful or negligent act or omission of Owner or Architect.

B. If a Change in the Work results from any event or circumstance caused by the willful or negligent act or omission of Owner or Architect, Contractor will give Owner Written Notice of such event or circumstance within twenty-four (24) hours after commencement of the event or circumstance so that Owner can take such action as is necessary to mitigate the effect of the event or circumstance. Contractor will not be entitled to any adjustment in either the Contract Time or the Contract Sum based on any damages or delays resulting from such event or circumstance during a period more than twenty-four (24) hours prior to Contractor giving such Written Notice to Owner.

C. Contractor will submit in writing any claims for an adjustment in the Contract Time and/or the Contract Sum resulting from an event or circumstance within the time limits set forth below. In the event that Contractor fails to submit its claim in writing within the time limits set forth below, then Contractor agrees it will not be entitled to any adjustment in the Contract Time or the Contract Sum or to any other damages from Owner due to the circumstance or event and waives any claim therefor.
   1. Claims for an adjustment in the Contract Time due to Adverse Weather will be made by the tenth (10th) of the month following the month in which the delay occurred.
   2. Claims for an adjustment in the Contract Time and/or the Contract Sum due to any other circumstance or event will be submitted within seven (7) days after the occurrence of the circumstance or event.

D. If Contractor claims that it is entitled to an adjustment in the Contract Sum (including without limitation costs related to a time extension) because of an event or circumstance resulting from the willful or negligent act or omission of Owner or Architect, Contractor will furnish a proposal for a Change Order containing a price breakdown as described in Section 7.1, Paragraph C. Any amount claimed for increased labor costs as a result of the event or circumstance must be supported by a certified payroll. Any claim for rented equipment or additional material costs must be supported by invoices.

E. If Contractor claims that it is entitled to an adjustment in the Contract Time as a result of an event or circumstance, Contractor will include with its claim copies of daily logs, letters, shipping orders, delivery tickets, Project schedules, and other supporting information necessary to justify Contractor's claim that the event or circumstance delayed Substantial Completion. If Contractor is entitled to an adjustment in the Contract Time as a result of an event or circumstance caused by the wilful or negligent act or omission of Owner or Architect, Contractor will be compensated for all costs related to the delay in accordance with Section 7.3, Paragraph B.

F. Within thirty (30) days after receipt of Contractor's claim, Architect will either deny the claim or recommend approval to Owner. If Owner approves the claim, the adjustment in the Contract Time and/or Contract Sum will be reflected in a Change Order pursuant to Section 7.5 or a Construction Change Directive pursuant to Section 7.6. If Owner or Architect denies Contractor's claim, Contractor may submit its claim as a dispute pursuant to Section 13 within thirty (30) days of receipt of the denial of the claim. If Contractor fails to submit its claim for resolution pursuant to Section 13 within the thirty (30) day time period, then Contractor agrees it is not entitled to any adjustment in the Contract Time and/ or Contract Sum or any other damages as a result of the event or circumstance and waives any claim therefor.

**7.3 EXTENSIONS OF TIME**

A. If Substantial Completion of the Project is delayed because of any of the following causes, then the Contract Time will be extended by Change Order for a period of time equal to such delay:
   1. Labor strikes or lock-outs;
   2. Adverse weather;
   3. Unusual delay in transportation;
   4. Unforeseen governmental requests or requirements;
   5. A Change in the Work resulting from an instruction by Owner or Architect to Contractor subject to the conditions set forth in Section 7.1; or
   6. Any other event or circumstance caused by the willful or negligent act or omission of Owner or Architect.

B. Contractor will not be entitled to any compensation for delay described in Section 7.3, Paragraph A, subparagraphs 1, 2, 3 and 4. For each day of delay in Substantial Completion described in Section 7.3, Paragraph A, subparagraphs 5 and 6, Contractor will be paid liquidated damages in the amount per day set forth in the Supplementary Conditions to compensate Contractor for all damages resulting from any delay including but not limited to damages for general conditions costs, additional job site costs, additional home office overhead costs, disruption costs, acceleration costs, increase in labor costs, increase in subcontract costs, increase in materials costs, and any other costs incident to the delay. Contractor will be entitled to no other compensation relating to the delay.

C. In no event will any time extension or cost adjustment be given on account of delay which reasonably should have been anticipated by the Contractor or in circumstances where performance of the Work is, was, or would have been, delayed by any other cause for which the Contractor is not entitled to an extension.

### 7.4 DOCUMENTATION OF CHANGES IN THE WORK

Every Change in the Work will be documented by a Change Order, a Construction Change Directive or a Field Change. If Owner, Architect and Contractor reach agreement regarding the adjustment in the Contract Sum, if any, and the adjustment in the Contract Time, if any, resulting from a Change in the Work, then the parties will execute a Change Order pursuant to Section 7.5. If Owner, Architect and Contractor cannot reach agreement regarding the adjustment in Contract Sum or the adjustment in Contract Time resulting from a Change in the Work, then Owner and Architect will issue a Construction Change Directive pursuant to Section 7.6. Field Changes require the agreement of Architect and Contractor only.

### 7.5 CHANGE ORDERS

Contractor's signature upon a Change Order is Contractor's acknowledgment that it is not entitled to any additional adjustment in the Contract Sum or the Contract Time or any other damages or compensation as a result of the Change in the Work other than that provided for in the Change Order, irrespective of whether a subsequent claim for additional compensation or time extensions relating to the Change in the Work is described as a change in the requirements of the Contract Documents, a delay, a disruption of the Work, an acceleration of the Work, an impact on the efficiency of performance of the Work, an equitable adjustment, or other claim and irrespective of whether the impact of the Change in the Work is considered singly or in conjunction with the impact of other Changes in the Work.

### 7.6 CONSTRUCTION CHANGE DIRECTIVES

A. Contractor will promptly comply with all Construction Change Directives.

B. Pending final resolution of any adjustment in the Contract Sum or Contract Time relating to a Construction Change Directive, the amounts proposed by Owner in the Construction Change Directive may be included in Contractor's payment requests once the work relating thereto is completed.

C. If after the work described in the Construction Change Directive is completed, Owner, Architect, and Contractor reach agreement on adjustments in the Contract Sum, Contract Time, or both, such agreement will be reflected in an appropriate Change Order.

D. If the parties do not reach agreement regarding an adjustment to the Contract Sum, Contract Time, or both relating to the Construction Change Directive within thirty (30) days of the completion of the work described therein, then Contractor may submit its claim for an adjustment pursuant to Section 13 within thirty (30) days of the completion of such work. Contractor agrees that if it fails to submit its claim for resolution pursuant to Section 13 within thirty (30) days of completion of the work described in the Construction Change Directive, then it will not be entitled to an adjustment in Contract Sum or Contract Time resulting from such work except as set forth in the Construction Change Directive and waives any claim therefor.

### 7.7 FIELD CHANGES

Architect and Contractor will sign a Field Change order listing the Change In The Work and the Contract Sum including markups before Contractor proceeds with the Field Change.

### 7.8 WAIVER OF CLAIMS

Except as set forth in Section 7, Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time or for any damages of any kind whatsoever resulting from an instruction from Owner or Architect, any event or circumstance, or any act or omission of Owner or Architect and Contractor expressly waives any and all claims therefor.

## SECTION 8 - TIME

### 8.1 TIME IS OF THE ESSENCE

All time limits stated in the Contract Documents are of the essence. By executing the Agreement, Contractor confirms that the Contract Time is a reasonable period for performing the Work. Contractor will proceed expeditiously with adequate resources and will achieve Substantial Completion within the Contract Time.

### 8.2 COMMENCEMENT OF THE WORK

Contractor will not commence work on the Project site until the date set forth in the Written Notice to proceed. However, Contractor may enter into subcontracts and secure material for the Project after receipt of the Agreement with Owner's authorized signature. Owner will issue the Written Notice to proceed within forty-five (45) days after Owner receives acceptable bonds and evidence of insurance pursuant to Section 11 unless Owner earlier terminates the Agreement pursuant to Section 14.

### 8.3 DELAY IN COMPLETION OF THE WORK

A. For each day after the expiration of the Contract Time that Contractor has not achieved Substantial Completion, Contractor will pay Owner the amount set forth in the Supplementary Conditions as liquidated damages for Owner's loss of use of the Project

and the added administrative expense to Owner to administer the Project during the period of delay. In addition, Contractor will reimburse Owner for any additional Architect's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses incurred by Owner as a result of the delay. Owner may deduct any liquidated damages or reimbursable expenses from any money due or to become due to Contractor. If the amount of liquidated damages and reimbursable expenses exceeds any amounts due to Contractor, Contractor will pay the difference to Owner within ten (10) days after receipt of a written request from Owner for payment.

B. At the time Architect certifies that Contractor has achieved Substantial Completion, Architect will identify the remaining items to be completed for final completion of the Work and will establish with Contractor a reasonable time for completion of those items. Architect will set forth the items to be completed and the time established for their completion in a Certificate of Substantial Completion. For each day that Contractor exceeds the time allowed for completion of the items set forth in the Certificate of Substantial Completion, Contractor will pay to Owner as liquidated damages for additional administrative expenses the amount set forth in the Supplementary Conditions. In addition, Contractor will reimburse Owner for any additional Architect's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses incurred by Owner as a result of the delay in completing such items.

## SECTION 9 - PAYMENTS AND COMPLETION

### 9.1 SCHEDULE OF VALUES

Contractor will submit to Architect a schedule of values which allocates the Contract Sum to various portions of the Work. The schedule of values will be supported by such data to substantiate its accuracy as required by Architect. This schedule, when accepted by Owner and Architect, will be used as a basis for reviewing Contractor's payment requests.

### 9.2 PAYMENT REQUESTS

A. Not more than once a month, Contractor will submit a payment request to Architect for Work completed, materials stored on the site, and for materials stored offsite as of the date of the payment request. The amount of the payment request will be based upon the schedule of values and will be equal to the value of the Work completed:
   1. Less retention;
   2. Less all prior amounts paid by Owner to Contractor as part of the Contract Sum; and
   3. Less allowable offsets.

   The payment request may include Changes in the Work that have been performed by Contractor and authorized by Owner and/or Architect pursuant to Section 7. If a payment request includes materials stored offsite, Contractor will include with the payment request a list of the materials, the location where they are stored and the written request of Contractor and its performance bond surety that payment be made for such materials.

B. Contractor warrants and guarantees that upon the receipt of payment for materials and equipment, whether incorporated in the Project or not, title to such materials and equipment will pass to Owner free and clear of all liens, claims, security interests, or encumbrances. Notwithstanding this payment and passage of title, Contractor will remain responsible for all such materials and equipment until actual delivery to the project site, incorporation into the Work, and final acceptance by Owner. Contractor further warrants that no material or equipment covered by a payment request is subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or any other person or entity.

### 9.3 PAYMENT REQUEST CERTIFICATION

A. Architect will, within seven (7) days after receipt of Contractor's payment request, forward to Owner the payment request certified for such amount as Architect determines is properly due. If Architect certifies less than the full amount of the payment request, Architect will notify Contractor and Owner of Architect's reasons for withholding certification of the full amount requested.

B. The certification of the payment request will constitute a representation by Architect to Owner based upon Architect's observations at the site and the data comprising the payment request, that the Work has progressed to the point indicated and that, to the best of Architect's knowledge, information, and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to minor deviations from the Contract Documents correctable prior to completion, and to specific qualifications expressed by Architect. However, the certification of the payment request will not constitute a representation that Architect has:
   1. Conducted exhaustive or continuous on-site inspections to check the quantity or quality of the Work;
   2. Reviewed construction means, methods, techniques, sequences, or procedures;
   3. Reviewed copies of requisitions received from Subcontractors or other data requested by Owner to substantiate Contractor's right to payment; or
   4. Made examination to ascertain how or for what purpose Contractor has used money previously paid on account of the Contract Sum.

C. In taking action on Contractor’s payment request, Owner will be entitled to rely on the accuracy and completeness of the information furnished by Contractor.

### 9.4 DECISIONS TO WITHHOLD CERTIFICATION AND PAYMENT

A. Architect may withhold certification of a payment request in whole or in part to the extent reasonably necessary to protect Owner if, in the opinion of Architect, the representations to Owner required by Section 9.3, Paragraph B cannot be accurately made. If

Architect is unable to certify payment in the amount of the payment request, Architect will notify Contractor and Owner as provided in Section 9.3, Paragraph A. If Contractor and Architect cannot agree on a revised amount, Architect will promptly certify a payment request for the amount for which Architect is able to make such representations to Owner. Architect may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a payment request previously certified, to such extent as may be necessary in Architect's opinion to protect Owner from loss because of:

1. Defective work not remedied;
2. Third-party claims filed or reasonable evidence indicating probable filing of such claims;
3. Failure of Contractor to make payments properly to Subcontractors for labor, materials, equipment, construction or services;
4. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
5. Damage to Owner or another contractor for which Contractor is responsible;
6. Reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance will not be adequate to cover the cost of completing the Work and damages for the anticipated delay; or
7. Contractor's persistent failure to carry out the Work in accordance with the Contract Documents.

B. Owner reserves the right to withhold payments to Contractor, subsequent to Architect's certification of any payment request, in order to protect Owner from loss due to any condition described in Section 9.4, Paragraph A, Subparagraphs 1 through 7. Upon satisfactory resolution of any such conditions, payments so withheld will be made.

### 9.5 PROGRESS PAYMENTS

A. Owner will pay Contractor progress payments within the parameters of Section 9.2 within fifteen (15) days after Owner receives the certified payment request from Architect.

B. Owner will make payments to Contractor by either placing the payments in the mail addressed to Contractor or by electronic transfer at Owner’s discretion.

C. Upon receipt of any payment from Owner, Contractor will pay to each Subcontractor the amount paid to Contractor on account of such Subcontractor's portion of the Work.

D. Contractor will maintain a copy of each payment request at the Project site for review by the Subcontractors.

E. No payment made under the Contract Documents, either in whole or in part, will be construed to be an acceptance of defective or improper materials or workmanship.

F. In addition and notwithstanding the foregoing, Owner will also withhold and retain 10% of payments made to Contractor.

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within forty-five (45) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

### 9.6 FINAL PAYMENT

A. Owner will make full and final payment of the Contract Sum within thirty (30) days of the completion of all of the following requirements:

1. Contractor has submitted its final payment request;
2. Architect has declared to Owner in writing that the Work is complete;
3. Contractor has obtained waiver and release upon final payment documents executed by all of the subcontractors performing work and/or providing materials covered by the Contractor’s final payment request; and
4. Contractor has collected and provided to Owner all manufacturers’ and other guaranties and warranties, properly signed and endorsed to Owner, that are required by the Contract Documents that extend for a period beyond one year after substantial completion. (Delivery of such guaranties and warranties will not relieve Contractor for any obligation assumed under any other provision of the Contract Documents.).

B. Acceptance of final payment by Contractor or any Subcontractor will constitute a waiver of claims by the payee except for those claims previously made in writing pursuant to Section 7 and identified by Contractor in its affidavit as still pending.

C. If the aggregate of previous payments made by Owner exceeds the amount due Contractor, Contractor will reimburse the difference to Owner.

## SECTION 10 - PROTECTION OF PERSONS AND PROPERTY

### 10.1 SAFETY PRECAUTIONS AND PROGRAMS

Contractor will be responsible to Owner for initiating and supervising all safety programs in connection with the performance of the Work.

### 10.2 SAFETY OF PERSONS AND PROPERTY

A. Contractor will take reasonable precautions to prevent damage, injury, or loss to:

1. All persons on the site;
2. The Work and materials and equipment to be incorporated into the Work; and
3. Other property at the site or adjacent to it.

B. Contractor will give notices and comply with applicable laws, ordinances, rules, regulations, and other lawful requirements of public authorities bearing on the safety or protection of persons and property. No work will be performed that may pose an undue safety hazard to Contractor, Contractor's employees, or any other person.

C. Contractor will designate a responsible member of its organization at the site whose duty will be the prevention of accidents. This person will be Contractor's onsite representative unless otherwise designated in writing by Contractor to Owner and Architect.

### 10.3 EMERGENCIES

In case of an emergency endangering life or threatening the safety of any person or property, Contractor may, without waiting for specific authorization from Architect or Owner, act at its own discretion to safeguard persons or property. Contractor will immediately notify Architect of such emergency action and make a full written report to Architect within five (5) days after the event.

### 10.4 HAZARDOUS MATERIALS

In the event the Contractor encounters on the site material reasonably believed to be hazardous materials which have not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Architect in writing. The Work in the affected area shall be resumed in the absence of hazardous materials, or when it has been rendered harmless, by written agreement of the Owner and Contractor.

## SECTION 11 - INSURANCE AND BONDS

### 11.1 CONTRACTOR'S LIABILITY INSURANCE

A. Contractor will obtain the following insurance and provide evidence thereof as described below prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier:
1. Workers Compensation Insurance.
2. Employers Liability Insurance with minimum limits of the greater of $500,000 E.L. each accident, $500,000 E. L. disease-each employee, $500,000 E.L. disease-policy limit or as required by the law of the state in which the Project is located.

3. Commercial General Liability Insurance – ISO Form CG 00 01 (12/07) or equivalent Occurrence policy which will provide primary coverage to the additional insureds (the Owner and the Architect) in the event of any Occurrence, Claim, or Suit with:
   a. Limits of the greater of Contractor's actual coverage amounts or the following:
      1) $2,000,000 General Aggregate;
      2) $2,000,000 Products - Comp/Ops Aggregate:
      3) $1,000,000 Personal and Advertising Liability:
      4) $1,000,000 Each Occurrence;
      5) $50,000 Fire Damage to Rented Premises (Each Occurrence).
   b. Endorsements attached to the General Liability policy including the following or their equivalent:
      1) ISO Form CG 25 03 (05/09), Amendment of Limits of Insurance (Designated Project or Premises), describing the Agreement and specifying limits as shown above.
      2) ISO Form CG 20 10 (07/04), Additional Insured -- Owners, Lessees, Or Contractors (Form B), naming Owner and Architect as additional insureds.
4. Automobile Liability Insurance, with:
   a. Combined Single Limit each accident in the amount of $1,000,000 or Contractor's actual coverage, whichever is greater; and
   b. Coverage applying to "Any Auto."

B. Contractor will provide evidence of such insurance to Owner as follows:
1. Deliver to Owner a Certificate of Liability Insurance, on ACORD 25 (2010/05) Form, or equivalent:
   a. Listing Owner and its consultants as the Certificate Holders and Additional Insured on the general liability and any excess liability policies;
   b. Attaching the ISO or equivalent endorsements set forth above to the Certificate of Liability Insurance;
   c. Identifying the Project;
   d. Listing the insurance companies providing coverage (All companies listed must be rated in A.M. Best Company Key Rating Guide-Property-Casualty and each company must have a rating of B+ Class VII or better. Companies which are not rated are not acceptable); and
   e. Bearing the name, address and telephone number of the producer and signed by an authorized representative of the producer. The signature may be original, stamped, or electronic.

C. Contractor will maintain, from commencement of the Work, Insurance coverage required herein as follows:
1. Commercial General Liability Insurance through expiration of warranty period specified in Section 12.2, Paragraph B. including completion of any warranty repairs; and
2. All other insurance through Final Payment.

D. Owner reserves the right to reject any insurance company, policy, endorsement, or certificate of insurance with or without cause.

E. Owner may, in writing and at its sole discretion, modify the insurance requirements.

F. The cost of insurance as required above will be the obligation of Contractor. Contractor will be responsible for payment of all deductible amounts under all insurance.

G. Owner will provide builders risk insurance for the cost of the Project. The policy will be written on an all risk basis with coverage for perils of wind, flood, earthquake, and terrorism, with exclusions standard for the insurance industry. The policy will be subject to a $5,000 deductible per occurrence which will be the responsibility of Contractor and will not be a reimbursable expense. Owner will provide a copy of the terms and conditions of the builders risk policy to Contractor upon Contractor's request. Contractor will comply with terms, conditions, and deadlines of the builders risk policy. The terms, conditions, and deadlines of the builders risk policy shall govern coverage. In addition, when there is a loss which may be covered by the builders risk insurance policy, Contractor will comply with the following:
   1. Contractor will report the loss immediately to builders risk commercial insurer by calling 1-866-537-7475 and shall make such further written submissions as required and otherwise comply with all requirements of the builders risk policy.
   2. Contractor will report the loss immediately to the Owner.
   3. Contractor will immediately notify its general liability insurance carrier of the loss.
   4. Contractor will take all necessary and appropriate actions to protect the property and individuals from further loss, harm, and injury. In the event there are damages resulting from fire or water, restoration shall be performed only by a certified restoration contractor.
   5. To the extent possible, Contractor will preserve and not disturb the evidence of the loss until after the builders risk commercial insurer and all interested parties and their insurance carriers have had the opportunity to view and investigate the site and loss.
   6. Contractor will cooperate with Owner and the builders risk commercial insurer in the investigation, documentation, and settlement of loss claims, including without limitation promptly responding to all requests for information and documentation from the builders risk commercial insurer and/or Owner.

### 11.2 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

A. Prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier, Contractor will furnish to Owner a performance bond and a labor and material payment bond each in an amount equal to one hundred percent (100%) of the Contract Sum as security for all obligations arising under the Contract Documents. Such bonds will:
   1. Be written on Form AIA Document A312 (1984).
   2. Be issued by a surety company or companies licensed in the state in which the Project is located and holding valid certificates of authority under Sections 9304 to 9308, Title 31, of the United States Code as acceptable sureties or reinsurance companies on federal bonds.
   3. Have a penal sum obligation not exceeding the authorization shown in the current revision of Circular #570 as issued by the United States Treasury Department, i.e. "Treasury List".
   4. Be accompanied by a certified copy of the power of attorney stating the authority of the attorney-in-fact executing the bonds on behalf of the surety.

B. Owner reserves the right to reject any surety company, performance bond, or labor and material payment bond with or without cause.

C. The cost of the bonds as required above will be the obligation of Contractor.

## SECTION 12 - UNCOVERING AND CORRECTION OF WORK

### 12.1 UNCOVERING OF WORK

Contractor will notify Architect at least twenty-four (24) hours in advance of performing work that would cover up work or otherwise make it difficult to perform inspections required by the Specifications or by applicable governing authorities. Should any such work be covered without proper notification having been given to Architect, Contractor will uncover that work for inspection at its own expense.

### 12.2 CORRECTION OF WORK

A. Contractor will promptly correct any portion of the Work that is rejected by Architect or which fails to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed, or completed. Contractor will bear the cost of correcting such rejected Work, including additional testing and inspection costs, compensation for Architect's services, and any other expenses made necessary thereby.

B. Contractor will remedy any defects due to faulty materials, equipment, or workmanship which appear within a period of one (1) year from the date of Substantial Completion or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents. Contractor will pay all costs of correcting faulty work, including without limitation additional Architect's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses when incurred.

C. Nothing in the Contract Documents will be construed to establish a period of limitation within which Owner may enforce the obligation of Contractor to comply with the Contract Documents. The one-year period specified above has no relationship to the time within which compliance with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations.

### 12.3 ACCEPTANCE OF NONCONFORMING WORK

A. If Owner prefers to accept any portion of the Work not in conformance with the Contract Documents, Owner may do so instead of requiring removal and correction of the nonconforming Work. In that event, the Contract Sum will be reduced by an amount agreed upon by the parties that reflects the difference in value to Owner between the Work as specified and the nonconforming Work. Such adjustment may consider increased maintenance costs, early replacement costs, increased inefficiency of use, and the like and will be effective whether or not final payment has been made. Such adjustment will be reflected in a Change Order pursuant to Section 7.5.

B. Temporary or trial usage by Owner or Architect of mechanical devices, machinery, apparatus, equipment, or other work or materials supplied under the Contract Documents prior to written acceptance by Architect, will not constitute Owner's acceptance.

## SECTION 13 - RESOLUTION OF DISPUTES

### 13.1 SUBMITTAL OF DISPUTE

In the event there is any dispute arising under this Agreement which cannot be resolved by agreement between the parties, either party may submit the dispute with all documentation upon which it relies to the Director of Architecture, Engineering, and Construction, Meetinghouse Facilities Department, 50 East North Temple, Salt Lake City, Utah 84150, who will convene a dispute resolution conference within thirty (30) days. The dispute resolution conference will constitute settlement negotiations and any settlement proposal made pursuant to the conference will not be admissible as evidence of liability. In the event that the parties do not resolve their dispute pursuant to the dispute resolution conference, either party may commence legal action to resolve the dispute. Any such action must be commenced within six (6) months from the first day of the dispute resolution conference or be time barred. Submission of the dispute to the Director as outlined above is a condition precedent to the right to commence legal action to resolve any dispute. In the event that either party commences legal action to adjudicate any dispute without first submitting the dispute to the Director, the other party will be entitled to obtain an order dismissing the litigation without prejudice and awarding such other party any costs and attorney fees incurred by that party in obtaining the dismissal, including without limitation copy costs, and expert and consultant fees and expenses.

### 13.2 CONTRACTOR TO PROCEED WITH DILIGENCE

Pending final resolution of a dispute hereunder, Contractor will proceed diligently with the performance of its obligations under this Agreement.

## SECTION 14 - TERMINATION

### 14.1 TERMINATION BY CONTRACTOR

In the event Owner materially breaches any term of the Contract Documents, Contractor will promptly give Written Notice of the breach to Owner. If Owner fails to cure the breach within ten (10) days of the Written Notice, Contractor may terminate the Agreement by giving Written Notice to Owner and recover from Owner the percentage of the Contract Sum represented by the Work completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets. Contractor will not be entitled to unearned profits or any other compensation or damages as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor’s indemnities and obligations under section 3.14 as well as all warranties in the specifications relative to Work provided through the date of termination survive a termination hereunder.

### 14.2 TERMINATION BY OWNER FOR CAUSE

Should Contractor fail to provide Owner with the bonds and certificates of insurance required by Section 11 within the time specified therein, make a general assignment for the benefit of its creditors, fail to apply enough properly skilled workmen or specified materials to properly prosecute the Work in accordance with Contractor’s schedule, or otherwise materially breach any provision of the Contract Documents, then Owner may, without any prejudice to any other right or remedy, give Contractor Written Notice thereof. If Contractor fails to cure its default within ten (10) days, Owner may terminate the Agreement by giving Written Notice to Contractor. In such case, Owner may, in Owner’s sole discretion, take legal assignment of subcontracts and other contractual rights of Contractor and/or take possession of the premises and all materials, tools, equipment, and appliances thereon, and finish the Work by whatever method Owner deems expedient. Contractor will not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Sum exceeds the expense of finishing the Work, including compensation for additional administrative, architectural, consultant, and legal services (including without limitation attorney fees, expert fees, copy costs, and other expenses), such excess will be paid to Contractor. If such expense exceeds the unpaid balance, Contractor will pay the difference to Owner. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor’s indemnities and obligations under section 3.14 as well as all warranties in the specifications relative to Work provided through the date of termination survive a termination hereunder.

### 14.3 TERMINATION BY OWNER FOR CONVENIENCE

Notwithstanding any other provision contained in the Contract Documents, Owner may, without cause and in its absolute discretion, terminate the Agreement at any time. In the event of such termination, Contractor will be entitled to recover from Owner the

percentage of the Contract Sum equal to the percentage of the Work which Architect determines has been completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets. Contractor will not be entitled to unearned profits or any other compensation as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Owner may, in Owner's sole discretion, take legal assignment of subcontracts and other contractual rights of Contractor. Without limitation, Contractor's indemnities and obligations under section 3.14 as well as all warranties in the specifications relative to Work provided through the date of termination survive a termination hereunder.

## SECTION 15 - MISCELLANEOUS PROVISIONS

### 15.1 GOVERNING LAW

The parties acknowledge that the Contract Documents have substantial connections to the State of Utah. The Contract Documents will be deemed to have been made, executed, and delivered in Salt Lake City, Utah. To the maximum extent permitted by law, (i) the Contract Documents and all matters related to their creation and performance will be governed by and enforced in accordance with the laws of the State of Utah, excluding conflicts of law rules; and (ii) all disputes arising from or related to the Contract Documents will be decided only in a state or federal court located in Salt Lake City, Utah and not in any other court or state. Toward that end, the parties hereby consent to the jurisdiction of the state and federal courts located in Salt Lake City, Utah and waive any other venue to which they might be entitled by virtue of domicile, habitual residence, place of business, or otherwise.

### 15.2 NO WAIVER

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

### 15.3 RULE OF CONSTRUCTION

Owner and Contractor agree that the Contract Documents will be deemed to have been drafted by both Owner and Contractor and will not be construed against either Owner or Contractor because of authorship.

### 15.4 ENFORCEMENT

In the event either party commences legal action to enforce or rescind any provision of the Contract Documents, the prevailing party will be entitled to recover its attorney fees and costs, including without limitation all copy costs and expert and consultant fees and expenses, incurred in that action and on all appeals, from the other party.

### 15.5 TESTS AND INSPECTIONS

A. Owner and Architect have the right to have tests made when they deem it necessary. Tests conducted by Owner or Architect will be paid for by Owner. Should a test reveal a failure of the Work to meet Contract Document requirements, the cost of the test as well as subsequent tests related to the failure necessary to determine compliance with the Contract Documents will be paid for by Owner, with the cost thereof deducted from the Contract Sum by Modification.

B. Tests will be made in accordance with recognized standards by a competent, independent testing laboratory. Materials found defective or not in conformity with Contract Document requirements will be promptly replaced or repaired at the expense of Contractor.

C. Owner and Architect have the right to obtain samples of materials to be used in the Work and to test samples for determining whether they meet Contract Document requirements. Samples required for testing will be furnished by Contractor and selected as directed by Architect. Samples may be required from the sample's source, point of manufacture, point of delivery, or point of installation at Architect's discretion. Samples not required as a Submittal in the Specifications will be paid for by Owner. Should tests reveal a failure of the Sample to meet the Contract Document requirements, Contractor will provide other Samples that comply with the requirements of the Contract Documents.

END OF DOCUMENT

# SUPPLEMENTARY CONDITIONS
## FIXED SUM (U.S.)

## ITEM 1 - GENERAL

1. Conditions of the Agreement and General Conditions apply to each Division of the Specifications.
2. Provisions contained in Division 01 apply to all Divisions of the Specifications.

## ITEM 2 - LIQUIDATED DAMAGE AMOUNTS:

1. The amount of liquidated damages to the benefit of the Contractor for delays under General Conditions Section 7.3, Paragraph B is $__250__ per day.
2. The amount of liquidated damages to be paid to the Owner for delays in Substantial Completion under General Conditions Section 8.3, Paragraph A is $__500__ per day.
3. The amount of liquidated damages to be paid to the Owner for delays in completing work itemized on the Substantial Completion Certificate under General Conditions Section 8.3, Paragraph B is $__500__ per day.

## ITEM 3 - PERMITS

1. Delete Section 3.6, Paragraph B of the General Conditions and replace with the following:

   B. Owner shall reimburse at cost the fees for the building permit to the contractor.

## ITEM 4 - MISCELLANEOUS CHANGES IN GENERAL CONDITIONS

1. FOR PROJECTS EXCEEDING $5 MILLION – CONTRACTOR TO PROVIDE BUILDER'S RISK INSURANCE (AND NOT OWNER)

*Replace Section 11.1 Contractor's Liability Insurance of the General Conditions with the following:*

### 11.1 CONTRACTOR'S LIABILITY INSURANCE

A. Contractor will obtain the following insurance and provide evidence thereof as described below prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier:

1. Workers Compensation Insurance.
2. Employers Liability Insurance with minimum limits of the greater of: $500,000 E.L. each accident, $500,000 E. L. disease-each employee, $500,000 E.L. disease-policy limit; or as required by the law of the state in which the Project is located.
3. Commercial General Liability Insurance – ISO Form CG 00 01 (12/07) or equivalent Occurrence policy which will provide primary coverage to the additional insureds (the Owner and the Architect) in the event of any Occurrence, Claim, or Suit with:
   a. Limits of the greater of: Contractor's actual coverage amounts or the following:
      1) $2,000,000 General Aggregate;

2) $2,000,000 Products - Comp/Ops Aggregate:

3) $1,000,000 Personal and Advertising Injury:

4) $1,000,000 Each Occurrence;

5) $50,000 Damage to Rented Premises.

b. Endorsements attached to the General Liability policy including the following or their equivalent:

1) ISO Form CG 25 03 (05/09), Designated Construction Project(s) General Aggregate Limit, describing the project and specifying that limits apply to each project of the contractor.

2) ISO Form CG 20 10 (07/04), Additional Insured – Owners, Lessees or Contractors – Scheduled Person or Organization, naming Owner and Architect as additional insureds.

4. Automobile Liability Insurance, with:

a. Combined Single Limit each accident in the amount of $1,000,000 or Contractor's actual coverage, whichever is greater; and

b. Coverage applying to "Any Auto" or equivalent to all owned autos, hired autos, and non-owned autos.

5. Builder's Risk Insurance Policy – ISO Form CP 00 20 (10/12), Builders Risk Coverage (or equivalent form) and ISO Form CP 10 30 (10/12) Causes of Loss – Special Form, and ISO Form CP 11 20 (06/07) Builders Risk – Collapse During Construction (or equivalent form) with Limits of Insurance in the amount of the Contract Sum.

a. Policy will cover materials stored at temporary storage locations and materials in transit.

b. Include Owner and Subcontractors as additional insureds.

c. Policy will be subject to a deductible of not less than $5,000 per occurrence which will be the responsibility of Contractor and will not be included in the Cost of the Work or be a reimbursable expense.

B. Contractor will provide evidence of such insurance to Owner as follows:

1. Deliver to Owner a Certificate of Insurance on ACORD 25 (2010/05) or equivalent:

a. Listing Owner as the Certificate Holder and Owner and Architect as Additional Insureds on general liability and any excess liability policies;

b. Attaching the endorsements set forth above for additional insured on general liability (CG 20 10 07/04) and Designated Construction Project Aggregate Limit (CG 25 03 05/09).

c. Identifying the Project.

d. Listing the insurance companies providing coverage. All companies must be rated in A.M. Best Company's Key Rating Guide – Property-Casualty, current edition, at a rating B+ Class VII or better. Companies that are not rated are not acceptable.

e. Bearing the name, address, and telephone number of the producer and signed by an authorized representative of the producer. The signature may be original, stamped, or electronic. A faxed or digital copy is also acceptable.

2. Deliver to Owner a Certificate of Insurance on ACORD 27, Evidence of Property

Insurance, for the Builders Risk Insurance Policy attaching the endorsement giving evidence that the Owner and all Subcontractors are listed as additional insureds on the Builders Risk Policy.

C. Contractor will maintain, from commencement of the Work, Insurance coverage required herein as follows:

1. Commercial General Liability Insurance through expiration of warranty period specified in Section 12.2, Paragraph B. including completion of any warranty repairs;
2. Builders' Risk Insurance through Substantial Completion; and
3. All other insurance through final payment.

D. In the event of a loss, or upon request by Owner, Contractor will provide Owner with a copy of required insurance policies above.

E. Owner reserves the right to reject any insurance company, policy, endorsement, or certificate of insurance with or without cause.

F. Owner may, in writing and at its sole discretion, modify the insurance requirements.

## ITEM 5 - STATE SPECIFIC SUPPLEMENTARY CONDITIONS

***Utah***

**RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN UTAH:**

*Replace section 9.5.F of the General Conditions with the following:*

F. In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor. These retention funds will be held in an interest bearing account.

**PAYMENT OF RETAINED FUNDS IN UTAH:**

*Replace section 9.5 G of the General Conditions with the following:*

G. After Contractor achieves Substantial Completion and submits its payment request for retained funds and delivers to the Architect Owner's form entitled "Contractor's Substantial Completion Affidavit and Consent of Surety" fully executed by Contractor and its surety, if any, and provides statutory Conditional Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within forty-five (45) days from the later of (a) the date Owner received Contractor's payment request for retained funds and fully executed Contractor's Substantial Completion Affidavit and Consent of Surety, (b) the date a certificate of occupancy is issued; (c) the date that a building inspector having authority to issue its own certificate of occupancy does not issue that certificate but permits occupancy.

**UTAH STATE SALES TAX:**

*Add the following to the General Conditions:*

1. Contractors should be exempt on purchases of material installed or converted into real property to be used by the Owner. The Contractor will furnish each vendor with a completed Exemption Certificate Form TC-721. The certificate will be prepared by the Contractor for each vendor in order to obtain the exemption.
2. The Owner's tax exempt number is 11871701-002-STC.

**UTAH NOTICE OF INTENT TO OBTAIN FINAL COMPLETION:**

*Add the following to the General Conditions:*

A. Contractor will file with the State Construction Registry, on its own behalf and/or on behalf of Owner, a notice of intent to obtain final completion at least 45 days before the day on which the Owner or Contractor files or could file a notice of completion under Utah Code Ann. Section 38-1a-506 if:
    1. The completion of performance time under the original contract for construction work is greater than 120 days;
    2. The total original construction contract price exceeds $500,000; and
    3. The original contractor or owner has not obtained a payment bond in accordance with Utah Code Ann. Section 14-2-1.

**UTAH NOTICE OF COMPLETION:**

*Add the following to the General Conditions:*

A. Within five (5) calendar days of final completion of the Project and in compliance with Section 38-1a-507 Utah Code Annotated, Contractor will file with the State Construction Registry, and copy to Owner, a notice of completion which will include, without limitation, the following:
    1. The name, address, telephone number, and email address of the person filing the notice of completion;
    2. The name of the county in which the Project and/or Project site is located;
    3. The date on which final completion is alleged to have occurred;
    4. The method used to determine final completion; and
    5. One of the following:
        a. The tax parcel identification number of each parcel included in the Project and/or Project site;
        b. The entry number of a preliminary notice on the same project that includes the tax parcel identification number of each parcel included in the Project and/or Project site; or
        c. The entry number of the building permit issued for the Project.
B. Notwithstanding any other provision of the Contract Documents to the contrary, Contractor and Owner agree that any breach or failure to comply with this Section by the Contractor will constitute a breach of contract and the Contractor will be liable for any direct, indirect, or consequential damages to the Owner flowing from this breach.

**UTAH PROGRESS PAYMENTS AND FINAL PAYMENT:**

*Replace Section 9.5.A of the General Conditions with the following:*

**9.5 PROGRESS PAYMENTS**

A. Owner will pay Contractor progress payments within the parameters of Section 9.2 within fifteen (15) days after:

1. Contractor has submitted a progress payment request;
2. Contractor has obtained Conditional Waiver and Release Upon Progress Payment documents (in content complying with Utah Code § 38-1a-802) executed by each of the subcontractors performing work and/or providing materials covered by the Contractor's progress payment request; and
3. Owner receives the certified payment request from Architect.

*Replace Section 9.6.A.3 of the General Conditions with the following:*

**9.6 FINAL PAYMENT**

3. Contractor has obtained Waiver and Release Upon Final Payment documents (in content complying with Utah Code § 38-1a-802) executed by each of the subcontractors performing work and/or providing materials covered by the Contractor's final payment request;

END OF DOCUMENT

**SECTION 01 1000**
**SUMMARY**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Summary of Work.

B. Work restrictions.

C. Owner-furnished materials.

D. Management of multiple contracts.

### 1.02 PROJECT

A. Project Name: LEGACY FARMS

B. Owner's Name: CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS

C. Architect's Name: UNCOMMON ARCHITECTS

D. The Project consists of the construction of A HERITAGE 24 STAKE CENTER WITH PAVILION AND STORAGE BUILDING.

### 1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. Provisions contained in Division 01 apply to Sections of Divisions 02 through 49 of Specifications. Instructions contained in Specifications are directed to Contractor. Unless specifically provided otherwise, obligations set forth in Contract Documents are obligations of Contractor

B. Contractor shall furnish total labor, materials, equipment, and services necessary to perform The Work in accordance with Contract Documents.

### 1.04 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price unless directed differently by owners representative.

### 1.05 WORK BY OWNER

A. Owner will furnish and install some portions of The Work with its own forces. Contractor will be provided with schedule of when these items are to be performed.
   1. General:
      a. Complete work necessary to accommodate work to be performed by Owner before scheduled date for performance of such work. Contractor will be back charged for actual expenses incurred by Owner for failure to timely complete such work.
      b. Store and protect completed work provided by Owner until date of Substantial Completion.

B. Owner will supply and install the following after Substantial Completion:
   1. High Security Cylinders and Cores:
   2. Carpet and Carpet Base.
   3. Window Treatments and Stage Curtain
   4. Owner will terminate building telephone cables at terminal board.
   5. Pews.

C. Owner will supply the following to be installed by the Contractor:
   1. Baby Changing Station. See Section 10 2800.
   2. Display Cases. See Section 10 1100.
   3. Fixed Glass/Markerboards. See Section 10 1100.
   4. Fixed Tackboards. See Section 10 1100.
   5. Interior Signage. See Section 10 1400.
   6. Network Equipment: See Section 27.
      a. Internet Firewall.

b. ISP Modem.
c. Network Switch.
d. Wireless Access Port.

7. Network Streaming Equipment. See Section 27.
8. Projection Screens. See Section 11 5213.
9. Rail Mounted Chalkboards / Markerboards. See Section 10 1100.
10. Scoreboards. See Section 11 6623.
11. Serving Area Appliances. See Section 11 3013.
12. Wall Padding. See Section 11 6623.
13. Selected Commercial Toilet Accessories
14. Artwork (to be installed after all other work has been completed and accepted by Owner) (Assume 20-34 Pieces)
15. Volleyball Equipment: See Section 11 6623.
    a. Volleyball floor sleeves (anchors) installed concrete slab.
    b. Volleyball upright (standard) storage unit.
    c. Volleyball cover plates and outer rings.

**1.06 ADMINISTRATIVE REQUIREMENTS**

A. Coordination:
   1. Coordinate sequence of activities to accommodate required quality assurance and quality control services with minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

B. Scheduling:
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

C. Review 'Contractor Notice of Owner Furnished Materials' notice listing Owner-furnished products to be delivered for Project:
   1. Review due (delivery) dates and vendor lead times for each item and coordinate with construction schedule. Immediately report recommended changes to Owner's Purchasing Coordinator listed in 'Contractor Notice of Owner Furnished Materials'. Contact vendors directly if changes to delivery dates become necessary during construction.
   2. Report problems in coordinating due (delivery) dates with construction schedule to Architect and Owner's Purchasing Coordinator.

D. Receive unload, store and properly protect Owner-furnished materials and products.
   1. Provide labor and equipment necessary to receive, unload, and store materials and products.
   2. Count number of pieces received and note any discrepancies on Delivery Receipt before driver leaves:
   3. Include Project Name and Project Number on Delivery Receipt.
   4. Check for visible evidence of damage such as holes, tears, or crushed portions of cartons and note on Delivery Receipt before driver leaves:
      a. If you are unsure if carton is damaged, take photo of cartons and share it with Owner's Purchasing Coordinator.

E. Within forty-eight (48) hours of delivery:
   1. Open and inspect each piece of freight delivered. Take picture of any concealed damage not reported at time of delivery and report it to Owner's Purchasing Coordinator.
   2. Compare 'Contractor Notice of Owner Furnished Materials' with packing slips. Note discrepancies in number, size, color, model numbers, etc.
   3. Deliver copy of Delivery Receipt (bill of lading) on which you have noted any loss or damage to Owner's Purchasing Coordinator. Include in your submission any report of concealed damage, discrepancies or photos.

F. Failure to strictly follow above procedures will result in Contractor's assumption of all financial responsibility for this shipment. All replacement and reorders must be made through Owner's

Purchasing Coordinator and must allow Owner's vendor sufficient lead time to produce and ship new product.

G. When above procedures are strictly followed, shortages and damaged items will be replaced by Owner at Owner's cost.

## 1.07 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

## 1.08 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations:
   1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Contractor will ensure that Contractor, its employees, subcontractors, and their employees comply with following requirements:
   1. Do not use or consume alcohol or cannabis, or illegal use drugs, on the Project Site or enter on or perform any Work on the Project Site while under their influence.
   2. Do not smoke or vape anything on the Project Site. Do not use tobacco in any form on the Project Site.
   3. Do not perform Work on the Project Site on Sundays except for emergency work.
   4. Refrain from using profanity or being discourteous or uncivil to others on the Project Site or while performing Work under this Agreement.
   5. Do not view or allow pornographic or other indecent materials on the Project Site.
   6. Do not play obnoxious and/or loud music on the Project Site. Do not play any music within existing facilities.
   7. Refrain from wearing immodest, offensive, or obnoxious clothing, while on the Project Site.
   8. Do not bring weapons on the Project Site.

C. Existing building spaces may not be used for storage.

D. Do not load or permit any part of the structure to be loaded with a weight that will endanger its safety. Questions of structural loading as part of construction means and methods shall be addressed by a licensed structural engineer engaged by Contractor, subject to the review by Architect.

## 1.09 MULTIPLE CONTRACT SUMMARY

A. Owner may issue separate contracts for operations scheduled to precede and be substantially completed before beginning of The Work under this Contract.
   1. Contractor will be given written notice from such contractors of any revisions to scheduled completion of their work at least 30 days in advance. Owner will reimburse Contractor for expenses incurred by Contractor by failure to be properly notified.

B. Owner has issued or will issue separate contracts for operations scheduled to be completed between Notice to Proceed and Substantial Completion.
   1. General:
      a. Schedule performance of work covered by such separate contracts in Contractor's Construction Schedule so as to avoid delays in Substantial Completion. Give written notice to such contractors and to Owner of any revisions to scheduled delivery and work dates at least 90 days in advance.
      b. Complete work necessary to accommodate items provided under such separate contracts before scheduled date for performance of such work. Contractor will be back charged for actual expenses incurred by Owner for failure to timely complete such work including, but not limited to, cost of crews during downtime or for call backs and costs to correct substrate deficiencies.

c. Store and protect completed work provided under separate contracts until date of Substantial Completion.

2. Separate contracts issued by Owner
   a. Basketball Equipment. See Section 11 6623.
   b. Projection Screens. See Section 11 5213.
   c. Sheet Carpeting.
   d. Soap dispensers, paper towel dispensers, and toilet tissue dispensers. See Section 10 2800.
   e. Testing and Inspection. See Section 01 4000 “Quality Requirements” for testing and inspection, and testing laboratory services for materials, products, and construction methods:

C. Owner has issued or will issue separate contracts for operations normally scheduled to follow Substantial Completion.
   1. General:
      a. Give written notice to such contractors and to Owner of any revisions of scheduled date of Substantial Completion at least 90 days in advance. Contractor will be back charged for actual expenses incurred by Owner for failure to accurately report date of Substantial Completion.
      b. Complete work necessary to accommodate items provided under such separate contracts before Substantial Completion. Contractor will be back charged for actual expenses incurred by Owner for failure to complete such work before Substantial Completion.
   2. Separate contracts issued by Owner
      a. See section 1.05, B in this section for a list of products installed under separate contracts.

**1.10 MULTIPLE CONTRACT COORDINATION**

A. Contractor shall be responsible for accurately maintaining and reporting schedule of The Work from Notice to Proceed to date of Substantial Completion.

B. Contractor shall be responsible for providing Temporary Facilities And Controls for those who perform work on Project from Notice to Proceed to date of Substantial Completion.

C. Contractor shall be responsible for providing Construction Waste Management And Disposal services for those who perform work on Project from Notice to Proceed to date of Substantial Completion.

D. Contractor shall be responsible for Final Cleaning for entire Project.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 01 1000**

**SECTION 01 2000**
**PRICE AND PAYMENT PROCEDURES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Procedures for preparation and submittal of application for final payment.

### 1.02 SCHEDULE OF VALUES

A. Submit schedule of values as directed by Owner's representative within 24 hours of project bid. Coordinate preparation of schedule of values with preparation of Contractor's Construction Schedule. Correlate line items in Schedule of Values with other required administrative schedules and forms, including:
   1. Contractor's Construction Schedule.
   2. Payment Request form.
   3. Schedule of Allowances.
   4. Schedule of Alternates.

B. Electronic media printout including equivalent information may be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

### 1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Use Payment Request forms provided by Owner.

C. Provide following submittals before or with submittal of Initial Payment Request:
   1. List of Subcontractors.
   2. Initial progress report.
   3. Contractor's Construction Schedule.
   4. Submittal Schedule.

D. Each Payment Request will be consistent with previous requests and payments certified by Architect and paid for by Owner.

E. Electronic media printout including equivalent information may be considered in lieu of standard form specified; submit sample to Architect for approval.

F. Forms filled out by hand will not be accepted.

G. Execute certification by signature of authorized officer.

H. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed.

I. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

J. Submit copy of each Application for Payment.

K. Construction progress schedule, revised and current as specified in Section 01 3216.

### 1.04 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Provide Affidavit of Contractor and Consent of Surety with Payment Request following Substantial Completion.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## SECTION 01 3000
## ADMINISTRATIVE REQUIREMENTS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Pre-Installation Conferences

E. Submittals for review, information, and project closeout.

F. Submittal procedures.

### 1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Project designation for this Project is Legacy Farms HER 24 Stake Center w/ Pavilion. This Project designation will be included on documents generated for Project by Contractor and Subcontractors, or be present on a cover letter accompanying such documents.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

### 3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Architect will record minutes and distribute copies within three working days after meeting to participants and those affected by decisions made.

### 3.02 PROGRESS MEETINGS

A. Architect will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Progress meetings will be open to Owner, Architect, Subcontractors, and anyone invited by Owner, Architect, and Contractor.

C. Architect will record minutes and distribute copies within three working days after meeting to participants and those affected by decisions made.

### 3.03 PRE-INSTALLATION CONFERENCES

A. Attend pre-installation conferences specified in Contract Documents.

1. If possible, schedule these conferences on same day as regularly scheduled Progress Meetings. If this is not possible, coordinate scheduling with Architect.
2. Request input from attendees in preparing agenda.

B. See individual specification sections for information to include in Pre-Installation Conferences.

C. Architect will record minutes and distribute copies within three working days after meeting to participants and those affected by decisions made.

### 3.04 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format, listing items specified to be furnished for review to Architect including product data, shop drawings, samples, and Informational Submittals.
   1. Submit at the same time as the preliminary schedule or 20 days after receipt of Notice to Proceed.
   2. Coordinate with Contractor's construction schedule.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Enclose the following information for each item:
      a. Scheduled date for first submittal.
      b. Related Section number.
      c. Submittal category.
      d. Name of Subcontractor.
      e. Description of part of the Work covered.
      f. Scheduled date for resubmittal.
      g. Scheduled date for Architect's final release or approval.
   5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
      b. Print and distribute copies to Architect and Owner and post copy in field office. When revisions are made, distribute to same parties and post in same location.
      c. Revise schedule monthly. Send copy of revised schedule to Owner and Architect and post copy in field office.

**3.05 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 and for record documents purposes described in Section 01 7800 - Closeout Submittals.

**3.06 SUBMITTALS FOR INFORMATION**

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.

7. Field engineering daily reports.
8. Special Procedure Submittals: Describe submittals intended to document special procedures. An example would be construction staging or phasing for remodeling an existing facility while keeping it in operation. While the Contractor would normally be responsible for managing this, submittal of his plan as documentation could be specified.
9. Qualification Statements: Describe submittals intended to document qualification of entities employed by Contractor.
10. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

### 3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Project Manual: Complete Project Manual including Addenda and Modifications as defined in General Conditions.
6. Record Documentation: Describe submittal of record documentation specific to the Section.
7. Software: Describe submittal system software and programming software specific to the Section.

D. Final Property Survey.

E. Submit for Owner's benefit during and after project completion.

### 3.08 MAINTENANCE MATERIAL SUBMITTALS

A. This title groups maintenance material required submittals specific to the Section. Items may be provided at completion of Work or submitted with section 01 7800 - Closeout Submittals:
1. Spare Parts: Describe spare parts necessary for Owner’s use in facility operation and maintenance. ‘Parts’ are generally understood to be items such as filters, motor drive belts, lamps, and other similar manufactured items that require only simple replacement.
2. Extra Stock Materials: Describe extra stock materials to be provided for Owner’s use in facility operation and maintenance. Extra stock materials are generally understood to be items such as ceiling tiles, flooring, paint etc.
3. Tools:
    a. Describe tools to be provided for Owner’s use in facility operation and maintenance. Tools are generally understood to be wrenches, gauges, circuit setters, etc, required for proper operation or maintenance of a system.

### 3.09 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

### 3.10 SUBMITTAL PROCEDURES

A. General Requirements:

1. Identification:
    a. Place permanent label or title block on each submittal for identification. Include name of entity that prepared each submittal on label or title block.
        1) Provide space approximately 4 by 5 inches on label or beside title block on Shop Drawings to record Contractor's review and approval markings and action taken.
        2) Include following information on label for processing and recording action taken:
            (a) Project name.
            (b) Date.
            (c) Name and address of Architect.
            (d) Name and address of Contractor.
            (e) Name and address of Subcontractor.
            (f) Name and address of supplier.
            (g) Name of manufacturer.
            (h) Number and title of appropriate Specification Section.
            (i) Drawing number and detail references, as appropriate.
2. Use a single transmittal for related items.
3. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
4. Transmit using approved form.
    a. Use Contractor's form, subject to prior approval by Architect.
5. Sequentially identify each item. For revised submittals use original number and a sequential "R" suffix.
6. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
7. 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.
8. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
    a. Deliver submittals to Architect at business address.
    b. Send submittals in electronic format via email to Architect.
9. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 21 days excluding delivery time to and from the Contractor.
    b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 10 days.
    c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
10. No extension of Contract Time will be authorized because of failure to transmit submittals to Architect in sufficient time before work is to be performed to allow processing.

B. Product Data Procedures:
    1. Mark each copy of each set of submittals to show choices and options used on Project. Where printed Product Data includes information on products that are not required for Project, mark copies to indicate information relating to Project.

2. Certify that proposed product complies with requirements of Contract Documents. List any deviations from those requirements on form or separate sheet.
3. Submit only information required by individual specification sections.
4. Collect required information into a single submittal.
5. Submit concurrently with related shop drawing submittal.
6. 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. Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches. Highlight, encircle, or otherwise show deviations from Contract Documents. Include following information as a minimum:
    a. Dimensions.
    b. Identification of products and materials included.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
4. Review and designate (stamp) approval of shop drawings. Unless otherwise specified, submit to Architect six copies of shop drawings required by Contract Documents. Shop drawings not required by Contract Documents, but requested by Contractor or supplied by Subcontractor, need not be submitted to Architect for review.

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.
4. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
    a. Mount, display, or package Samples to ease review of qualities specified. Prepare Samples to match samples provided by Architect, if applicable. Include following:
        1) Generic description of Sample.
        2) Sample source.
        3) Product name or name of manufacturer.
        4) Compliance with recognized standards.
        5) Availability and delivery time.
5. Submit Samples for review of kind, color, pattern, and texture, for final check of these characteristics with other elements, and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
    a. Where variations in color, pattern, texture or other characteristics are inherent in material or product represented, submit set of three samples minimum that show approximate limits of variations.

b. Refer to other specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
c. Refer to other Sections for Samples to be returned to Contractor for incorporation into The Work. Such Samples shall be undamaged at time of use. On transmittal, indicate special requests regarding disposition of Sample submittals.

6. Where Samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit full set of choices for material or product. Preliminary submittals will be reviewed and returned with Architect's mark indicating selection and other action.
7. Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three sets. One will be returned marked with action taken.
8. Samples, as accepted and returned by Architect, will be used for quality comparisons throughout course of construction.
   a. Unless noncompliance with Contract Documents is observed, submittal may serve as final submittal.
   b. Sample sets may be used to obtain final acceptance of construction associated with each set.

**END OF SECTION**

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## SECTION 01 3216
## CONSTRUCTION PROGRESS SCHEDULE

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

C. Construction progress schedule, with network analysis diagrams and reports if required by Owner.

D. Daily Construction Reports.

### 1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

### 1.03 SCHEDULE FORMAT

A. Provide separate time bar for each construction activity listed on Owner's payment request form.

B. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

C. Sheet Size: Multiples of 8-1/2 x 11 inches.

D. Scale and Spacing: To allow for notations and revisions.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

### 3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

### 3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Provide separate time bar for each construction activity listed on Owner's payment request form.

C. Identify each item by specification section number.

D. Identify work of separate stages and other logically grouped activities.

E. Provide sub-schedules to define critical portions of the entire schedule.

F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

G. Indicate delivery dates for owner-furnished products.

H. Coordinate content with schedule of values specified in Section 01 2000 - Price and Payment Procedures.

I. Provide legend for symbols and abbreviations used.

### 3.03 ACCELERATION OF WORK

A. Complete The Work in accordance with Construction Schedule. If Contractor falls behind schedule, take such actions as are necessary, at no additional expense to Owner, to bring progress of The Work back in accordance with schedule.

B. Owner may request proposal for completion of The Work at date earlier than expiration of Contract Time:
   1. Promptly provide requested proposal showing cost of such acceleration of The Work. Consult with Owner and Architect regarding possible options to decrease cost of such acceleration.
   2. If Owner determines to order acceleration of The Work, change in Contract Sum and Contract Time resulting from acceleration will be included in a Change Order.

### 3.04 BAR CHARTS

A. Provide separate time bar for each construction activity listed on Owner's payment request form.

B. Include a separate bar for each major portion of Work or operation.

C. Identify the first work day of each week.

D. Project Management Software Programs:
   1. Any software project management program capable of Bar Chart Scheduling for projects of equal size and complexity is approved by Contractor and approved by Owner’s Project Manager.

### 3.05 NETWORK ANALYSIS IF REQUIRED BY OWNER

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and re-computation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. By responsibility in order of earliest possible start date.
   4. In order of latest allowable start dates.
   5. In order of latest allowable finish dates.
   6. Contractor's periodic payment request sorted by Schedule of Values listings.
   7. Listing of basic input data that generates the report.
   8. Listing of activities on the critical path.

**3.06 REVIEW AND EVALUATION OF SCHEDULE**

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

**3.07 UPDATING SCHEDULE**

A. Update schedule monthly.

B. Maintain schedules to record actual start and finish dates of completed activities.

C. Indicate progress of each activity to date of revision, with projected completion date of each activity.

D. Annotate diagrams to graphically depict current status of Work.

E. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

F. Indicate changes required to maintain Date of Substantial Completion.

G. Submit reports required to support recommended changes.

H. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

**3.08 DISTRIBUTION OF SCHEDULE**

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

**3.09 DAILY CONSTRUCTION REPORTS**

A. Prepare daily reports utilizing means and methods as defined by the Owner.

B. Prepare daily reports of operations at Project including at least the following information:
   1. Approximate count of personnel at site.
   2. High and low temperatures, general weather conditions.
   3. Materials, equipment, or Owner-furnished items arriving at or leaving site.
   4. Accidents and unusual events.
   5. Site or structure damage by water, frost, wind, or other causes.
   6. Stoppages, delays, shortages, losses.
   7. Any tests made and their result if known.
   8. Meter readings and similar recordings.
   9. Emergency procedures.
   10. Orders and requests of governing authorities.

11. Services connected, disconnected.
12. Equipment or system tests and start-ups.
13. Brief summary of work accomplished that day.
14. Signature of person preparing report.

C. Submit daily reports to Architect at least weekly unless directed to submit reports on owner provided project management software.

D. Maintain copies of daily reports at field office.

**END OF SECTION**

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**SECTION 01 4000**
**QUALITY REQUIREMENTS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. Qualifications.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

### 1.02 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.

### 1.03 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:

1. Temporary sheeting, shoring, or supports.
2. Temporary scaffolding.
3. Temporary bracing.
4. Temporary falsework for support of spanning or arched structures.
5. Temporary foundation underpinning.
6. Temporary stairs or steps required for construction access only.
7. Temporary hoist(s) and rigging.
8. Investigation of soil conditions and design of temporary foundations to support construction equipment.

### 1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.

### 1.05 SUBMITTALS

A. General: Additional submittal requirements are specified in Individual Sections in Division 01 through Division 50.

B. Certificates:
   1. Testing Agency will submit certified written report of each inspection, test, or similar service.

C. Tests and Evaluation Reports:
   1. Testing Agency or Agencies will prepare logs, test reports, and certificates applicable to specific tests and inspections and deliver copies (or electronic record) distributed as follows:
      a. 1 copy to Owner's Representative.
      b. 1 copy to Architect.
      c. 1 copy to Consulting Engineers (Engineer of Record).
      d. 1 copy to General Contractor.
      e. 1 copy to Authorities Having Jurisdiction (if required).
   2. Other tests, certificates, and similar documents will be obtained by Contractor and delivered to Owner's Representative and Architect in such time as not to delay progress of the Work or final payment therefore.
   3. Submittal Format:
      a. Schedule of Tests and Inspections: Prepare in tabular form and include following:
         1) Specification Section number and title.
         2) Description of test and inspection.
         3) Identification of applicable standards.
         4) Identification of test and inspection methods.
         5) Number of tests and inspections required.
         6) Time schedule or time span for tests and inspections.
         7) Entity responsible for performing tests and inspections.
         8) Requirements for obtaining samples.
      b. Certified written reports of each inspection, test, or similar service will include, but not be limited:
         1) Date of issue.
         2) Project title and number.
         3) Name, address, and telephone number of Testing Agency.
         4) Dates and locations of samples and tests or inspections.
         5) Names of individuals making tests and inspections.
         6) Description of the Work and test and inspection method.
         7) Identification of product and Specification Section.
         8) Complete test or inspection data.
         9) Test and inspection results and an interpretation of test results.
         10) Record of temperature and weather conditions at time of sample taking and testing and inspecting.
         11) Comments or professional opinion on whether tested or inspected Work complies with Contract Document requirements.
         12) Name and signature of laboratory inspector.
         13) Recommendations on retesting and re-inspecting.

D. Source Quality Control Submittals:
   1. Testing Agency will submit following prior to commencing the Work:
      a. Qualifications of Testing Agency management and personnel designated to project.
      b. Testing Agency 'Written Practice for Quality Assurance'.

c. Qualification records for Inspector and non-destructive testing technicians designated for project.
d. Testing Agency non-destructive testing procedures, equipment calibration records, and personnel training records.
e. Testing Agency Quality Control Plan for monitoring and control of testing operations.
f. Welding Inspection Procedures (Structural Steel testing).
g. Bolting Inspection Procedures (Structural Steel testing).
h. Shear Connector Stud Inspection Procedures (Structural Steel testing).
i. Seismic Connections Inspection Procedures (Structural Steel testing).

E. Testing and Inspection Reports:
1. Conduct and interpret tests and inspections and state in each report whether tested and inspected the Work complies with or deviates from requirements.
2. Laboratory Reports: Testing Agency will furnish reports of materials and construction as required, including:
a. Description of method of test.
b. Identification of sample and portion of the Work tested.
1) Description of location in the Work of sample.
2) Time and date when sample was obtained.
3) Weather and climatic conditions at time when sample was obtained.
c. Evaluation of results of tests including recommendations for action.
3. Inspection Reports:
a. Testing Agency will furnish 'Inspection at Site' reports for each site visit documenting activities, observations, and inspections.
b. Include notation of weather and climatic conditions, time and date conditions and status of the Work, actions taken, and recommendations or evaluation of the Work.
4. Reporting Testing and Inspection (Conforming Work):
a. Submit testing and inspection reports as required within twenty four (24) hours of test or inspection having been performed.
5. Reporting Testing and Inspection Defective Work (Non-Conforming Work):
a. Testing Agency, upon determination of irregularities, deficiencies observed or test failure(s) observed in the Work during performance of its services of test or inspection having been performed, will:
1) Verbally notify results to Architect, Contractor, and Owner's Representative within one hour of test or inspection having been performed (if Defective Work (Non-Conforming Work) is incorporated into project).
2) Submit written inspection report and test results as required within twenty four (24) hours of test or inspection having been performed.
b. Prepare non-compliance log to track non-compliant testing or inspections.
6. Final Report:
a. Submit final report of tests and inspections at Substantial Completion, which identify unresolved deficiencies.

## 1.06 QUALIFICATIONS

A. Qualifications paragraphs in this Article establish minimum qualification levels required; individual Specification Sections specify additional requirements:
1. Fabricator / Supplier / Installer Qualifications: Firm experienced in producing products similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units.

a. Approved:
    1) Where heading ‘Approved Suppliers / Distributors / Installers / Applicators / Fabricators' is used to identify list of specified suppliers / distributors / installers / applicators / fabricators, use only listed suppliers / installers / fabricators.
    2) No substitutions will be allowed.
b. Acceptable Suppliers / Installers:
    1) Where heading ‘Acceptable Suppliers / Installers / Fabricators' is used, qualifications as specified in Quality Assurance in Part 1 of individual sections will be used to determine requirements of those that will be acceptable to be used on Project. Lists for acceptable installers can include additional installers that may be approved before bidding or by addendum.

2. Factory-Authorized Service Representative Qualifications:
    a. Authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
3. Installer Qualifications:
    a. Firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
4. Manufacturer Qualifications:
    a. Firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
5. Manufacturer’s Field Services Qualifications:
    a. Experienced authorized representative of manufacturer to inspect field-assembled components and equipment installation, including service connections.
6. Professional Engineer Qualifications:
    a. Professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
7. Specialists:
    a. Certain sections of Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations.
    b. Specialists shall satisfy qualification requirements indicated and shall be engaged for activities indicated.
    c. Requirement for specialists shall not supersede building codes and regulations governing the Work.
8. Testing Agency Qualifications:
    a. Independent Testing Agency with experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
        1) Testing Laboratory:
            (a) AASHTO Materials Reference Laboratory (AMRL) Accreditation Program.
            (b) Cement and Concrete Reference Laboratory (CCRL).
            (c) Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7.

(d) National Voluntary Laboratory (NVLAP): Testing Agency accredited according to National Institute of Standards and Technology (NIST) Technology Administration, U. S. Department of Commerce Accreditation Program.

### 1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Testing and inspecting services are used to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

B. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform specified testing and inspection.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 QUALITY ASSURANCE

A. Activities, actions, and procedures performed before and during execution of the Work to verify compliance and guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Owner or Owner's designated representative(s) will perform quality assurance to verify compliance with Contract Documents.

### 3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Demonstrate proposed range of aesthetic effects and workmanship.

D. Notify Architect seven (7) working days in advance of dates and times when mock-ups will be constructed.

E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.

2. Make corrections as necessary until Architect's approval is issued.

H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

## 3.03 QUALITY CONTROL

A. Quality Control Services:
   1. Quality Control will be sole responsibility of Contractor.
      a. Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements performed by Contractor:
         1) They do not include inspections, tests or related actions performed by Architect, Owner, governing authorities or independent agencies hired by Owner or Architect.
         2) Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
      b. Where services are indicated as Contractor's responsibility, engage a qualified Testing Agency to perform these quality control services.
         1) Contractor shall not employ same testing entity engaged by Owner, without Owner’s written approval.

## 3.04 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

## 3.05 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Activities performed by Owner’s Quality Assurance Testing Agency include, but are not limited to following:
   1. Individual Sections in Division 01 through Division 49:
      a. Pre-Installation Conference agenda review items for:
         1) Schedule requirements.
         2) Testing and inspection requirements:
         3) Requirements and frequency of testing and inspections.
         4) Mock-up or sample requirements.
         5) Submittals requirements.
      b. Quality Assurance personal qualifications.
         1) Qualification documentation including certificates if required.
      c. Non-Conforming Work:
         1) Prepare non-compliance log to track non-compliant testing or inspections.
   2. Weekly Activities:
      a. Summarize and track any non-compliance issues.
      b. Provide summary report of previous week’s performed Work.

c. Visit contractors periodically to find out if they have any concerns with Quality Assurance inspectors and check on any schedule changes.
d. Visit Owner's Representatives periodically to find out if they have any concerns with how project is progressing.

C. Testing Agency Duties:
1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests/inspections specified.

D. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

E. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
a. To provide access to Work to be tested/inspected.
b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
c. To facilitate tests/inspections.
d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

F. Architect Duties:
1. Notify Owner's Representative before each test and/or inspection.

G. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

H. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

**3.06 MANUFACTURERS' FIELD SERVICES**

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
   1. Observer subject to approval of Architect.
   2. Observer subject to approval of Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

**3.07 DEFECT ASSESSMENT**

A. Replace Work or portions of the Work not complying with specified requirements.

B. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
   2. Comply with Contract Document requirements for Section 01 7000 - Execution and Closeout Requirements for cutting and patching.

C. Protect construction exposed by or for Quality Assurance and Quality Control activities.

D. Repair and protection are Contractor's responsibility, regardless of assignment of responsibility for Quality Assurance and Quality Control Services.

**END OF SECTION**

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**SECTION 01 4219**
**REFERENCE STANDARDS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

### 1.02 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with the reference standard of date of issue specified in this section, except where a specific date is established by applicable code.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Date of Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

G. Minimum Quantity or Quality Levels:
   1. Quantity or quality level shown or specified shall be minimum provided or performed.
   2. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits.
   3. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for context of requirements.

H. Coordination:
   1. Coordinate sequence of activities to accommodate required quality assurance and quality control services with minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

I. Scheduling:
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

### 1.03 INDUSTRY STANDARDS

A. Except where Contract Documents specify otherwise, construction industry standards will apply and are made a part of Contract Documents by reference.

B. Where compliance with two or more standards is specified and standards apparently establish different or conflicting requirements for minimum quantities or quality levels, refer to Architect for decision before proceeding. Quantity or quality level shown or specified will be minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for context of requirements. Refer uncertainties to Architect for decision before proceeding.

C. Each entity engaged in construction on Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with Contract Documents. Where copies of standards are needed for performance of a required construction activity, Contractor will obtain copies directly from publication source.

D. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

**1.04 GOVERNING REGULATIONS**

A. Governing Regulations / Authorities:
   1. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.
   2. Obtain copies of regulations required to be retained at Project Site, available for reference by parties who have a reasonable need for such reference.

**1.05 ABMA -- AMERICAN BEARING MANUFACTURERS ASSOCIATION, INC.**

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015 (Reaffirmed 2020).

**1.06 AHRI -- AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE**

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addenda (2011).

B. AHRI 430 (I-P) - Performance Rating of Central Station Air-handling Unit Supply Fans 2020.

C. AHRI 610 (I-P) - Standard for Performance Rating of Central System Humidifiers for Residential Applications 2014.

D. AHRI 851 (SI) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013.

**1.07 AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.**

**1.08 AITC -- AMERICAN INSTITUTE OF TIMBER CONSTRUCTION**

**1.09 ALI -- AMERICAN LADDER INSTITUTE**

A. ALI A14.3 - Ladders - Fixed - Safety Requirements 2008.

**1.10 AMCA -- AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.**

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.

B. AMCA 99 - Standards Handbook 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

G. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.

H. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2012 (Reapproved 2015).

**1.11 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.**

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers 2022.

### 1.12 ASSE -- AMERICAN SOCIETY OF SANITARY ENGINEERING

### 1.13 ASTM A SERIES -- ASTM INTERNATIONAL

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

### 1.14 ASTM B SERIES -- ASTM INTERNATIONAL

A. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating 2011 (Reapproved 2021).

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

### 1.15 ASTM C SERIES -- ASTM INTERNATIONAL

A. ASTM C1184 - Standard Specification for Structural Silicone Sealants 2018, with Editorial Revision.

### 1.16 ASTM D SERIES -- ASTM INTERNATIONAL

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position 2022.

C. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting 2018.

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

### 1.17 ASTM E SERIES -- ASTM INTERNATIONAL

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies 2018.

C. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS) 2022.

### 1.18 ASTM G SERIES -- ASTM INTERNATIONAL

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

### 1.19 AWI/AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK INSTITUTE/ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

### 1.20 BIA -- BRICK INDUSTRY ASSOCIATION

### 1.21 HPVA -- HARDWOOD PLYWOOD VENEER ASSOCIATION

### 1.22 ICC-ES -- ICC EVALUATION SERVICE, INC.

A. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies 2009, with Editorial Revision (2012).

### 1.23 ISO -- INTERNATIONAL STANDARDS ORGANIZATION

**1.24 MFMA -- MAPLE FLOORING MANUFACTURERS ASSOCIATION**

**1.25 MFMA -- METAL FRAMING MANUFACTURERS ASSOCIATION**

A. MFMA-4 - Metal Framing Standards Publication 2004.

**1.26 MPI -- MASTER PAINTERS INSTITUTE (MASTER PAINTERS AND DECORATORS ASSOCIATION)**

A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

**1.27 MSS -- MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC.**

A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

**1.28 NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS**

A. NAAMM AMP 510 - Metal Stairs Manual 1992.

**1.29 NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION**

A. NEMA MG 1 - Motors and Generators 2021.

**1.30 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION**

A. NFPA 54 - National Fuel Gas Code 2021.

B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

D. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2021.

E. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances 2019.

F. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.

**1.31 NSF -- NSF INTERNATIONAL (THE PUBLIC HEALTH AND SAFETY ORGANIZATION)**

**1.32 RCSC -- RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS**

**1.33 RIS -- REDWOOD INSPECTION SERVICE**

**1.34 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.**

A. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

**1.35 TMS -- THE MASONRY SOCIETY**

**1.36 TPI -- TRUSS PLATE INSTITUTE**

**1.37 UL -- UNDERWRITERS LABORATORIES INC.**

A. UL (DIR) - Online Certifications Directory Current Edition.

B. UL 705 - Power Ventilators Current Edition, Including All Revisions.

C. UL 900 - Standard for Air Filter Units Current Edition, Including All Revisions.

**END OF SECTION**

**SECTION 01 4543**
**FONT WATER ADJUSTING AND BALANCING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Is Not Limited To:
   1. Balance and adjust font water system services provided by Owner as described in Contract Documents.

B. Related Requirements:
   1. Division 01: 'General Requirements':
      a. Section 01 1000 - Summary: Owner will provide test, balance, and adjust font water systems. PART 3 of this Section establishes requirements for field tests of 'Testing Agency'.
      b. Section 01 4000 - Quality Requirements: for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   2. Division 22:
      a. Completing installation and start-up of plumbing systems, including hot water heater, as required for correct balance.
      b. Maintaining plumbing system and equipment in full operation during each working day of balancing and adjusting.

### 1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Contractor to assist Testing Agency in balancing of font water system.

B. Scheduling:
   1. Contractor to schedule this work in cooperation with other Sections involved and to comply with completion date for balance and adjust font water system as described in Contract Documents.
   2. Contact Testing Agency and coordinate (Owner's Representative to provide 'Testing Agency' contact information):
      a. One inspection when 90% of plumbing system is installed. Coordinate visit with 90% ductwork and equipment inspection.
   3. Contact Testing Agency and coordinate date(s) for adjusting and balancing work when following is completed (Owner's Representative to provide 'Testing Agency' contact information):
      a. Potable hot and cold water systems including installation of water heaters, specialties, and devices.
      b. Verification of proper water temperature control calibration and setting of control components and correct operation of water heater.
   4. If, in opinion of Testing Agency, the work is not ready for adjusting and balancing, reschedule as required.

### 1.03 SUBMITTALS

A. Informational Submittals:
   1. Test and Evaluation Reports:
      a. Preliminary Report(s):
         1) Copy to be given to Owner's Representative.
      b. Final Report :
         1) Copy to be given to Owner's Representative.

B. Closeout Submittals:

1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    a. Record Documentation:
        1) Testing and Inspection Reports:
            (a) Testing Agency Testing and Evaluation Final Report of balancing and adjusting font water system. Bind approved copy of Testing and Evaluation Report in Operations And Maintenance Manual for Division 22.

## 1.04 QUALITY ASSURANCE

A. Qualifications:
    1. Approved Testing Agency. Section 01 4000 applies, but is not limited to following:
        a. Testing Agency shall specialize in testing and balancing of hot water heating systems.
        b. Testing Agency shall provide proof of having successfully completed at least five years of specialized experience in hydronic system balancing.
        c. Testing Agency shall provide testing under direct supervision of qualified heating and ventilating engineer.
        d. Neither Architect's engineering consultant nor anyone performing work on this Project under other Sections of Division 22 shall be permitted to do this work.

## PART 2 PRODUCTS: NOT USED

## PART 3 EXECUTION

## 3.01 OWNER-FURNISHED TESTING AND INSPECTION

A. Owner to provide Testing and Inspection for testing, balancing, and adjusting font water systems:
    1. See Section 01 1000: Multiple contracts for administrative and procedural requirements for Testing and Inspection services.

## 3.02 PREPARATION

A. Water heater, building plumbing systems, and font water supply and drain systems shall be in full operation and continue in operation during each working day of adjusting and balancing.

## 3.03 FIELD QUALITY CONTROL

A. Field Tests:
    1. Font Water System:
        a. Testing Agency shall provide testing and inspection for Font Water System:
        b. Site Tests (Purge balance meter using potable water before balancing font water):
            1) Balancing And Adjusting Procedure (140 deg F (60 deg C) water heater discharge temperature):
                (a) Open main font water supply valve. Set mixing valve to discharge 100F water into font.
                (b) Verify settings by opening font supply valve and checking temperature gauge reading and hot water balancing device setting. Adjust as required. Close font supply valve.
            2) Balancing And Adjusting Procedure: (110 deg F (43 deg C) water heater discharge temperature):
                (a) Open main font water supply valve. Set hot water balancing device first. Set device to full open. Set cold water balancing device so temperature gauge reads 100 deg F (38 deg C). Close main supply valve.
                (b) Verify settings by opening font supply valve and checking temperature gauge reading and hot water balancing device setting. Adjust as required. Close font supply valve.

### 3.04 CLOSEOUT ACTIVITIES

A. Post copy of appropriate ‘Balancing And Adjusting Procedure’ inside Font Valve Box cover.

**END OF SECTION**

**SECTION 01 4546**
**DUCT TESTING, ADJUSTING, AND BALANCING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Is Not Limited To:
   1. Test, balance, and adjust air duct systems services provided by Owner as described in Contract Documents.

B. Related Requirements:
   1. Division 01: 'General Requirements':
      a. Section 01 1000 - Summary: Owner will provide test, balance, and adjust air duct systems. PART 3 of this Section establishes requirements for field tests of 'Testing Agency'.
      b. Section 01 4000 - Quality Requirements: for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   2. Division 23:
      a. Completing installation and start-up of mechanical systems, and changing sheaves, belts, and dampers as required for correct balance.
      b. Maintain HVAC system and equipment in full operation each working day of testing, balancing, and adjusting.

### 1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Contractor to assist Testing Agency in testing and balancing of mechanical system.
   2. Assisting Testing Agency in testing and balancing of mechanical system.

B. Scheduling:
   1. Contractor to schedule this work in cooperation with other Sections involved and to comply with completion date for test, balance, and adjust air duct systems as described in Contract Documents.
   2. Contact Testing Agency and coordinate (Owner's Representative to provide 'Testing Agency' contact information):
      a. One inspection when 60 percent of ductwork is installed.
      b. One inspection when 90 percent of equipment and ductwork is installed.
   3. Contact Testing Agency and coordinate date(s) for test and balance work when following is completed:
      a. HVAC and exhaust systems including installation of specialties, devices, and new filters.
      b. Proper function of control system components including electrical interlocks, damper sequences, air and water reset, and fire and freeze stats has been verified.
      c. Automatic temperature controls have been calibrated and set for design operating conditions.
      d. Verification of proper thermostat calibration and setting of control components such as static pressure controllers and other devices that may need set points changed during process of balancing system.
   4. If, in opinion of Testing Agency, systems are not ready for test and balance, reschedule as required.

### 1.03 SUBMITTALS

A. Informational Submittals:

1. Test and Evaluation Reports:
    a. Preliminary Report(s):
        1) Copy to be given to Owner's Representative.
    b. Final Report:
        1) Copy to be given to Owner's Representative.

B. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    a. Record Documentation:
        1) Testing and Inspection Reports:
            (a) Testing Agency Testing and Evaluation Final Report of testing, balancing, and adjusting air duct systems. Bind approved copy of Testing and Evaluation Report in Operations And Maintenance Manual for Division 23.

## 1.04 QUALITY ASSURANCE

A. Qualifications:
1. Approved Testing Agency. Section 01 4000 applies, but is not limited to following:
    a. Testing Agency shall specialize in testing and balancing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.
    b. Testing Agency shall provide proof of having successfully completed at least five years of specialized experience in air and hydronic system balancing.
    c. Testing Agency shall provide testing under direct supervision of qualified heating and ventilating engineer.
    d. Neither Architect's engineering consultant nor anyone performing work on this Project under other Sections of Division 23 shall be permitted to do this work.

## PART 2 PRODUCTS: NOT USED

## PART 3 EXECUTION

## 3.01 OWNER-FURNISHED TESTING AND INSPECTION

A. Owner to provide Testing and Inspection for testing, balancing, and adjusting air duct systems:
1. See Section 01 1000: Multiple contracts for administrative and procedural requirements for Testing and Inspection services.

## 3.02 FIELD QUALITY CONTROL

A. Field Tests
1. Air System Testing, Adjusting, And Balance:
    a. Inspections and site visits. (For paragraph a thru c, note deficiencies, if any, that needs to be corrected and report this to Owner's Representative, Architect, and Mechanical Engineer):
        1) One inspection when ductwork installation is 60 percent complete.
        2) One inspection when ductwork is installation is 90 percent complete.
        3) One inspection when potable hot and cold water system is 90 percent complete.
        4) Site visit for test and balance. Before commencing test and balance, perform an inspection to verify 100 percent completion of system. Confirm completion of work, correction of previously noted deficiencies, and look for new deficiencies not noted in previous inspections. If the work is complete, then proceed with test and balance. If the work is not complete and ready for test and balance, inform Contractor and submit an invoice to Owner's Representative for compensation for travel time, expenses, and time on site. Report deficiencies or

incomplete work to Owner's Representative, Architect, and Mechanical Engineer.

5) Additional site visits (beyond those set forth above) to complete the work after issues are resolved may be needed and will be paid for separately from compensation for services set forth in this Agreement, pursuant to hourly rates and conditions set forth in Attachment "A".

b. Checklist for Inspections and site visits:

1) Pre-Startup Inspection - use for inspections and site visits a thru d in paragraph 1 above. All pertinent items shall be checked, including but not limited to following:
   (a) Removal of shipping blocks and stops.
   (b) Vibration isolators' alignment and adjustment.
   (c) Flexible connections properly installed and aligned.
   (d) Safety controls, safety valves and high or low limits in operation.
   (e) All systems properly filled.
   (f) Filters in place and seal provided around edges.
   (g) Filters and strainers are clean.
   (h) Fire damper installation and operation, and access door installation.
   (i) Installation of all gauges on equipment.
   (j) Control system is operating.
   (k) All dampers, valves, and operators are properly installed and operating.
   (l) All ductwork is installed and sealed.
   (m) Voltage to unit matches nameplate voltage.

2) First Run Inspection - use for inspections and site visits d and e in paragraph 1 above. Recheck items in Pre-Startup list, and check for following items:
   (a) Excessive vibration or noise.
   (b) Loose components.
   (c) Initial control settings.
   (d) Motor amperages.
   (e) Heat buildup in motors.
   (f) Control system is calibrated and functioning as required.

3) System Operation Inspection - use for inspections and site visits d and e in paragraph 1 above. Observe mechanical systems under operation for sufficient amount of time to ensure proper operation in all running modes. Check following items periodically.
   (a) Filters and strainers.
   (b) Filters and strainers.
   (c) Check for system leaks at seals and valves.

c. Performance Requirements:

1) Testing and balancing in complete accordance with Associated Air Balance Council (AABC) Standards for Field Measurement & Instructions.

2) Noise level in chapel and / or cultural hall shall not exceed NC 35 with all HVAC equipment operating in full or second stage cooling mode.

d. Site tests: Air Test and Balancing Procedure:

1) Instruments used by Consultant shall be accurately calibrated and maintained in good working order.

2) All supply air and return air fans in all HVAC zone systems, energy recovery ventilators, and exhaust fans in building shall be operating when final setup of all units is performed.
3) Perform tests at high and low speeds of multi-speed systems and single speed systems.
4) Perform following testing and balancing functions in accordance with Associated Air Balance Council National Standards.
   (a) Fan Speeds - Air handling units (with variable pitch pulleys and sheaves): Test and adjust fan RPM to achieve design CFM requirements.
   (b) Fan Speeds - Furnaces (with direct drive motors): Set fan speed to lowest possible setting that will achieve design CFM requirements. Adjust down from Contractor setting, if necessary. Adjust low voltage fan speed jumpers (provided and installed by installing contractor) as necessary to achieve design cooling air flow at lowest possible setting. An exception to this would be when furnace is variable speed blower for dehumidification applications.
   (c) Current And Voltage: Measure and record motor current and voltage.
   (d) Pitot-Tube Traverse Method:
      (1) Make measurements in duct where velocity is uniform, 7-1/2 duct diameters downstream and 2 duct diameters minimum upstream from any turbulence, i.e., elbow, damper, take-off, etc.
      (2) Perform pitot-tube traverse of outdoor ventilation air duct serving each piece of air moving equipment.
      (3) Where single outdoor ventilation air trunk duct serves multiple pieces of equipment, perform pitot-tube traverse of duct branch serving each piece of equipment as well as pitot-tube traverse of total air flow in trunk with all pieces of equipment operating.
   (e) Where pitot-tube traverse is not possible or if pitot-tube traverse is unreliable, flow hood measurement over exterior intake louver or grille is acceptable for measuring outdoor ventilation air.
   (f) Use proportionate method of air balance leaving fan at lowest possible speed and at least one branch balance damper fully open.
5) Static Pressure: Test and record system static pressures, including suction and discharge static pressure of each fan.
6) Air Temperature: Take dry bulb air temperatures on entering and leaving side of each cooling coil. Dry bulb temperatures shall be taken on entering and leaving side of each heating unit.
7) Zone Ducts: Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.
8) Branch Ducts: Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
9) Tolerances: Test and balance all fans, zone ducts, registers, diffusers etc. to + or - 10 percent of design CFM.
10) Identification: Identify location and area of each grille, diffuser, register, and terminal box. Record on air outlet data sheets.
11) Description: Record size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.
12) Drafts: Adjust diffusers, grilles, and registers to minimize drafts. For high sidewall supply air diffusers install horizontal blade core to direct air flow upward

15 degree and set adjustable vertical blades to spread air flow horizontally and evenly in fan pattern.

13) Permanently mark all outside air, supply air, and return air damper positions after balancing has been completed.

14) Smoke testing: Smoke testing, or some other approved means, may be required to determine leak locations if air balance report indicates that any system's CFM total is less than 90 percent of design CFM. Prior to test, verify that system's duct joints have been sealed as specified and that air moving device in question is supplying required design system air flow. Mechanical Engineer will approve test method required. If smoke test is selected, use following procedure. Provide necessary precautions to protect those performing or observing test from being exposed to smoke.
    (a) Use zinc chloride smoke candles, titanium tetrachloride ampules or sticks, or other devices acceptable to Mechanical engineer to generate smoke.
    (b) Close openings in duct except for one opening at farthest end of duct run.
    (c) Circulate smoke at pressurized condition of 1/2 inch (13 mm) minimum water gauge static pressure.
    (d) Report findings to mechanical engineer in writing.

e. Air System Test and Evaluation Report:
    1) Record test data on AABC standard forms or facsimile.
    2) Preliminary Report: Provide and deliver four copies of complete data for evaluation and approval to Owner.
    3) Final report: Provide and deliver complete four copies of final report to Owner prior to project Substantial Completion date.
    4) Complete with logs, data, and records as required herein. Print logs, data, and records on white bond paper bound together in report form.
    5) Certified accurate and complete by Consultant’s certified test and balance engineer.
    6) Contain following general data in format selected by Consultant:
        (a) Project Number.
        (b) Project Title.
        (c) Project Location.
        (d) Project Architect and Mechanical Engineer.
        (e) Consultant and Certified Engineer.
        (f) Contractor and mechanical sub-contractor.
        (g) Dates tests were performed.
        (h) Certification Document.
        (i) Report Forms similar to AABC Standard format.
    7) Report shall include following:
        (a) Instrumentation List including type, model, manufacturer, serial number, and calibration dates.
        (b) HVAC zone identification to include reduced ductwork floor plan from project documents with outlets and inlets numbered to match written test and balance report. This page may be oversized but it should fold up neatly within standard 81/2 x 11 report paper size.
        (c) Record following for each piece of air handling equipment:
            (1) Manufacturer, model number, and serial number.
            (2) Design and manufacture rated data.

(3) Actual CFM.
(4) Suction and discharge static pressure of each fan.
(5) Outdoor-ventilation-air and return-air total CFM.
(6) Final RPM of each motor or speed tap.
(7) Actual operating current and voltage of each fan motor.
(8) Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
(9) Belt size and quantity.

**3.03 PREPARATION**

A. Heating, ventilating, and cooling systems and equipment shall be in full operation and continue in operation during each working day of testing and balancing.

**END OF SECTION**

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**SECTION 01 5000**
**TEMPORARY FACILITIES AND CONTROLS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Safety.

B. Temporary utilities.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Temporary erosion and sediment control.

F. Temporary tree and plant protection.

G. Security requirements.

H. Waste removal facilities and services.

I. Field offices.

### 1.02 RELATED REQUIREMENTS

A. Section 01 5100 - Temporary Utilities.

### 1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Protection of Existing Improvements: Protect streets, private roads, and sidewalks, including overhead protection where required. Repair damage to existing improvements caused by construction activities.

B. Protection of Adjacent Property: Provide necessary protection for adjacent property and lateral support thereof.

C. Proprietary Camera Services: In its absolute discretion, and with or without notice to Contractor, Owner may provide from time to time, but is not obligated to provide, one or more cameras on or about Project site and/or signage or notices of the same:

1. If provided by Owner, such camera(s) and/or signage and notices are solely for Owner's benefit and convenience and shall not be for benefit of Contractor, Subcontractor(s) or for any third person.
2. Owner shall have no liability, obligation, or responsibility to Contractor, Subcontractors, or any third person relative to such camera(s), signage, or notices, or absence of camera(s), signage, or notices, including without limitation, installation, maintenance, operation, repair, testing, functionality, capacity, recording, monitoring, posting, etc., of the same (hereafter 'Proprietary Camera Services').
3. Contractor, with Owner's prior consent (which shall not be unreasonably withheld), may relocate such camera(s), signage, or notices as necessary to not unreasonably, materially and physically interfere with work at Project Site.
4. Contractor's obligations under Contract Documents, including but not limited to, Contractor's obligation for security of Project Site, are not modified by Owner's opportunity to provide, actually providing, or not providing Proprietary Camera Services and/or signage or notices regarding the same.
5. This Specification Section does not preclude Contractor from providing its own camera(s), signage, or notices pursuant to terms and conditions of this Agreement. Neither does this

Section reduce, expand or modify any other right or obligation of Owner pursuant to terms of this Agreement.

D. Prepare schedule indicating dates for implementation and termination of each temporary facility.

E. Keep temporary facilities clean and neat in appearance. Operate in safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or allow them to interfere with progress of The Work. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on Project site.

F. Maintain facilities in good operating condition until removal.

G. Remove each temporary facility when need has ended, or when replaced by authorized use of permanent facility, or by Substantial Completion. Complete permanent construction that may have been delayed because of interference with temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that make up temporary facilities are property of Contractor.
   2. By Substantial Completion, clean and renovate permanent facilities used during construction period.

## 1.05 SAFETY REQUIREMENTS

A. Meet regulations of 29 CFR 1926 OSHA, 'Construction Industry Regulations'.

B. Owner's Safety Requirements:
   1. Personal Protection:
      a. Contractor shall ensure:
         1) Positive means of fall protection, such as guardrails system, safety net system, personal fall arrest system, etc., is provided to employees whenever exposed to a fall 6 feet (1.80 m) or more above a lower level.
         2) Personnel working on Project shall wear hard hats and safety glasses as required by regulation and hazard.
         3) Personnel working on Project shall wear long or short sleeve shirts, long pants, and hard-toed boots or other sturdy shoes appropriate to type and phase of work being performed.
   2. Contractor Tools and Equipment:
      a. Contractor shall ensure:
         1) Tools and equipment are in good working condition, well maintained, and have necessary guards in place.
         2) Ground Fault Circuit Interrupters (GFCI) is utilized on power cords and tools.
         3) Scaffolding and man lifts are in good working condition, erected and maintained as required by governmental regulations.
         4) Ladders are in good condition, well maintained, used as specified by Manufacturer, and secured as required.
   3. Miscellaneous:
      a. Contractor shall ensure:
         1) Protection is provided on protruding rebar and other similar objects.
         2) General Contractor Superintendent has completed the OSHA 10-hour construction outreach training course or equivalent.
         3) Implementation and administration of safety program on Project.
         4) Material Safety Data Sheets (MSDS) are provided for substances or materials for which an MSDS is required by governmental regulations before bringing on site.

5) Consistent safety training is provided to employees on Project.
6) Implement and coordinate Lockout / Tagout procedures with Owner's Representative as required.

b. Report accidents involving injury to employees on Project that require off-site medical treatment to Owner's designated representative.

4. Hot Work Permit:
   a. Permit shall document that fire prevention and protection requirements in 29 CFR 1926.352, 'Fire Prevention' have been implemented prior to beginning hot work operations.
      1) Required for doing hot work involving open flames or producing heat or sparks such as:
         (a) Brazing.
         (b) Cutting.
         (c) Grinding.
         (d) Soldering.
         (e) Thawing pipe.
         (f) Torch applied roofing.
         (g) Welding.

**1.06 TEMPORARY UTILITIES - SEE SECTION 01 5100**

**1.07 TEMPORARY SANITARY FACILITIES**

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain in clean and sanitary condition.

C. At end of construction, return facilities to same or better condition as originally found.

**1.08 BARRIERS**

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

E. Secure building at the end of each workday.

F. Maintain exterior building security until Substantial Completion.

**1.09 FENCING**

A. Construction: Contractor's option.

B. Before construction begins, install a fence sufficient in height and structure to protect the site and preclude access except through lockable entrance gates. Locate where shown on Drawings. If not shown on Drawings, enclose entire site or portion sufficient to accommodate construction operations.

**1.10 EXTERIOR ENCLOSURES**

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and

maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

### 1.11 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

### 1.12 SCAFFOLDING, PLATFORMS, STAIRS, ETC

A. Furnish and maintain equipment such as temporary stairs, ladders, ramps, platforms, scaffolds, hoists, runways, derricks, chutes, and elevators as required for proper execution of The Work.

B. Apparatus, equipment, and construction shall meet requirements of applicable laws and safety regulations.

### 1.13 TEMPORARY EROSION AND SEDIMENT CONTROL

A. Take precautions necessary to prevent erosion and transportation of soil downstream, to adjacent properties, and into on-site or off-site drainage systems.

B. Develop, install, and maintain an erosion control plan if required by law.

C. Repair and correct damage caused by erosion.

### 1.14 TEMPORARY ENVIRONMENTAL CONTROLS

A. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and reduce possibility that air, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result:
   1. Avoid use of tools and equipment that produce harmful noise.
   2. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near site.

B. Provide protection against weather (rain, winds, storms, frost, or heat) to maintain all work, materials, apparatus, and fixtures free from injury or damage.

C. Protect excavation, trenches, and building from damage from rainwater, spring water, ground water, backing up of drains or sewers, and all other water:
   1. For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with requirements of applicable local regulations. Where feasible, use permanent facilities.
   2. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.

D. Comply with governing ordinances relating to weed control and removal.

### 1.15 TEMPORARY TREE AND PLANT PROTECTION

A. Protection:
   1. Before commencing site work, build and maintain protective fencing around existing trees and vegetation as shown on the drawings.
   2. Individual trees will have protective fencing built beyond drip line.
   3. Build protective fencing around groups of trees and other vegetation as indicated on Drawings.
   4. Keep areas within protective fencing undisturbed and do not use for any purpose.

B. Maintenance:
   1. Maintain existing tree, shrubs, and vegetation as indicated in Contract Documents:
      a. Remove and replace vegetation that dies or is damaged beyond repair due to construction.
      b. Damage to any tree, shrub, or vegetation that has been indicated to remain and be protected, will have a cost associated with it. This includes branches, trunk and root systems:
         1) Trees: $1,000.00.
         2) Shrubs: $ 100.00.
         3) Vegetation: $ 50.00.

C. Pruning:
   1. Provide a qualified Tree Service Firm if pruning is required:
      a. Coordinate with authorities having jurisdiction.
      b. Coordinate with Owner and Architect on site before pruning is to begin.

### 1.16 WASTE REMOVAL

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

### 1.17 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture, drawing rack, drawing display table, locking door, light(s), table(s), bench(es), rack(s) for drawings, telephone, and fax machine. Provide an operable fire extinguisher in facility.

B. Provide hardhats for Owner's Representatives for site visits.

C. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

D. If Owner agrees to permit removal of temporary office before Substantial Completion, Contractor may use a room as an office after temporary office is removed. Equip room as specified above and restore to "like-new" condition before Substantial Completion.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

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**SECTION 01 5100**
**TEMPORARY UTILITIES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

### 1.02 ADMINISTRATIVE REQUIREMENTS

A. Where necessary, engage appropriate local utility companies to install temporary service or connect to existing service. Where utility company provides only part of service, provide remainder with matching, compatible materials and equipment. Comply with utility company's recommendations.
   1. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction.
   2. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.
   3. Arrange with utility company and existing users for time when service can be interrupted, where necessary, to make connections for temporary services.
   4. Provide adequate capacity at each stage of construction. Before temporary utility availability, provide trucked-in services.
   5. Obtain construction easements necessary to bring temporary and/or permanent utilities to site.
   6. Use qualified personnel for installation and maintenance of temporary facilities. Locate temporary utilities where they will serve Project adequately and result in minimum interference with the Work of Owner or other Contractors on Project Site. Relocate and modify temporary utilities as required.
   7. Pay cost and use charges for temporary and permanent utilities until Substantial Completion has been granted by Owner.

B. Prepare schedule indicating dates for implementation and termination of each temporary utility. At earliest feasible time, change over from use of temporary service to use of permanent service.

C. Keep temporary utilities clean and neat in appearance. Operate in safe and efficient manner. Take necessary fire prevention measures. Do not overload utilities, or allow them to interfere with progress of The Work. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on Project site.

D. Limit availability of temporary utilities to essential and intended uses to reduce waste and abuse.

E. Maintain temporary utilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
   2. Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

F. Remove each temporary utility and control when need has ended, or when replaced by permanent utility, but not later than Substantial Completion. Complete permanent construction that may have been delayed because of interference with temporary utility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

G. Materials and facilities that make up temporary utilities are property of Contractor.
   1. By Substantial Completion, clean and renovate permanent utilities used during construction period, including but not limited to:
      a. Replace air filters and clean inside of ductwork and housings.
      b. Replace significantly worn parts and parts subjected to unusual operating conditions.
      c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

## 1.03 TEMPORARY ELECTRICITY

A. Cost: By Contractor.

B. Provided weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period.

## 1.04 TEMPORARY FIRE PROTECTION

A. Cost: By Contractor.

B. Install and maintain temporary fire protection facilities of types needed to protect against predictable and controllable fire losses. At a minimum, provide and maintain in working order two Standard UL Labeled ABC all-purpose 10 lb fire extinguishers. Do not incorporate these extinguishers into final Project.
   1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires.
   4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
   5. At earliest feasible date in each area of Project, complete installation of permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

## 1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Install and operate temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

C. Maintain lighting and provide routine repairs.

D. Permanent building lighting may be utilized during construction.

## 1.06 TEMPORARY HEATING AND COOLING

A. Cost of Energy: By Contractor.

B. Install and operate temporary heating, cooling, and ventilating units including fuel, temporary piping, fittings, wiring, and connections necessary to provide environmental conditions specified for various portions of the Work. Coordinate ventilation requirements to produce ambient conditions required and reduce consumption of energy.

C. Repair damage to building and contents caused by cold, heat, dampness, and/or heating, cooling, and ventilating equipment. Select equipment that will not have harmful effect on completed installations or on elements being installed.

D. Provide heating and cooling devices and heat as needed to maintain specified conditions for construction operations.

1. Operate equipment according to equipment manufacturer's instructions.
2. Provide fresh air ventilation required by equipment manufacturer.
3. Keep temperature of fuel containers stabilized.
4. Secure fuel containers from overturning.
5. Operate equipment away from combustible materials.

E. Maintain minimum ambient temperature of between 50 and 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

F. Existing facilities shall not be used.

G. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

H. Do not operate system when work causing air-borne dust is occurring or when dust caused by such work is present without installation of temporary filtering system approved by Architect.

I. Operate system at no cost to Owner, including cost of fuel.

J. Assume all responsibility and risk for operation of system.

K. Return permanent mechanical equipment to 'like-new' condition for Substantial Completion Inspection.

**1.07 TEMPORARY WATER SERVICE**

A. Cost of Water Used: By Contractor.

B. Connect to existing water source.
1. Exercise measures to conserve water.
2. Provide separate metering and reimburse Owner for cost of water used.

C. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

**1.08 TEMPORARY TELEPHONES**

A. Contractor will, at a non-reimbursable cost and expense, provide temporary telephone service for all personnel engaged in construction activities, throughout construction period.

B. Contractor will pay for Local calls. Party making call will pay for long-distance and toll calls.

C. At each telephone, post list of important telephone numbers.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

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**SECTION 01 5813**
**TEMPORARY PROJECT SIGNAGE**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Project identification sign.

### 1.02 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr wind velocity.

### 1.03 SUBMITTALS

A. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

## PART 2 PRODUCTS

### 2.01 PROJECT IDENTIFICATION SIGN

A. Provide a temporary project Identification sign:
   1. Sign may be free-standing or attached to temporary field office or storage shed.
   2. No other signs or advertisements are allowed on building site.
   3. Sign will be no larger than 4 feet by 8 feet and include following information:
      a. Project Name as shown in Contract Documents.
      b. Contractor's name.
      c. Architectural firm name.
   4. Owner reserves the right to remove and/or take possession of any project identification sign.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at designated location.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

E. Paint exposed surfaces of sign, supports, and framing.

### 3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

### 3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

**END OF SECTION**

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**SECTION 01 6000**
**PRODUCT REQUIREMENTS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

### 1.02 SUBMITTALS

A. As indicated in technical sections in accordance with Section 01 3000.

## PART 2 PRODUCTS

### 2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

### 2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and for intended use and effect.

C. Provide interchangeable components of the same manufacturer for components being replaced.

D. Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on surfaces of products that will be exposed to view in occupied spaces or on building exterior.

1. Locate required product labels and stamps on concealed surface or, where required for observation after installation, on accessible surface that is not conspicuous.
2. Provide permanent nameplates on items of service-connected or power-operated equipment. Locate on easily accessible surface that is inconspicuous in occupied spaces. Nameplate will contain following information and other essential operating data:
    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

### 2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by manufacturer for application described. General overall performance of product is implied where product is specified for specific application. Manufacturer's recommendations may be contained in published product literature, or by manufacturer's certification of performance.

C. Where specifications only require compliance with an imposed code, standard, or regulation, select product that complies with standards, codes or regulations specified.

D. Where Specifications require matching an established Sample, Architect's decision will be final on whether proposed product matches satisfactorily. Where no product available within specified category matches satisfactorily nor complies with other specified requirements, refer to Architect.

E. Where specified product requirements include phrase "...as selected from manufacturer's standard colors, patterns, textures..." or similar phrase, select product and manufacturer that comply with other specified requirements. Architect will select color, pattern, and texture from product line selected.

F. Remove and replace products and materials not specified in Contract Documents but installed in the Work with specified products and materials at no additional cost to Owner and for no increase in Contract time.

G. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

H. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

## PART 3 EXECUTION

### 3.01 SUBSTITUTION LIMITATIONS

A. Product selection is governed by Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include:
   1. Substitutions and Equal Products:
      a. Substitutions for specified products and systems, as defined in the Uniform Commercial Code, are not acceptable. However, equal products may be approved upon compliance with Contract Document requirements.
      b. Approved Products / Manufacturers / Suppliers / Distributors / Fabricators / Installers:
   2. Acceptable Products / Manufacturers / Suppliers / Installers:
      a. Use ‘Equal Product Approval Request Form’ to request approval of equal products, manufacturers, or suppliers before bidding or before installation, as noted in individual Sections.
   3. Quality / Performance Standard Products / Manufacturers:
      a. Products / manufacturers used shall conform to Contract Document requirements.
   4. Comparable Product Requests:
      a. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles:
         1) Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
         2) Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

(a) Form of Approval: As specified in Division 01 Section "Submittal Procedures."

(b) Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

3) Submit five copies of each required submittal unless otherwise required. Architect will return three copies marked with action taken and with corrections or modifications required.

4) Submit electronic files: PDF. Architect will return a PDF copy marked with action taken and with corrections or modifications required.

## 3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage or theft; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Schedule delivery to reduce long-term storage at site and to prevent overcrowding of construction spaces.

E. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

F. Transport and handle products in accordance with manufacturer's instructions.

G. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

H. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

I. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

J. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

## 3.03 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. Store heavy materials away from Project structure so supporting construction will not be endangered.

H. For exterior storage of fabricated products, place on sloped supports above ground.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer's warranty conditions, if any.

K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

L. Prevent contact with material that may cause corrosion, discoloration, or staining.

M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

**3.04 NON-CONFORMING WORK**

A. Non-conforming work as covered in General Conditions applies, but is not limited, to use of non-specified products or manufacturers.

**END OF SECTION**

**SECTION 01 7000**
**EXECUTION AND CLOSEOUT REQUIREMENTS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Surveying for laying out the work.

C. Cleaning and protection.

D. General requirements for maintenance service.

### 1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

### 1.03 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

### 1.04 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
   2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
2. Outdoors: Limit conduct of especially noisy exterior work to [7:00 am - 9:00 pm].
3. Indoors: Limit conduct of especially noisy interior work to [7:00 am - 9:00 pm].

I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
1. Pest Control Service: [__3__] treatments.

J. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

K. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

## PART 2 PRODUCTS

### 2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### 3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### 3.03 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

## 3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations to extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents. Notify Architect of conflicts between Manufacturer's installation instructions and Contract Document requirements.

B. Provide attachment and connection devices and methods necessary for securing Work. Secure work true to line and level. Anchor each product securely in place, accurately located, and aligned with other Work. Allow for expansion and building movement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain best visual effect. Refer questionable choices to Architect for final decision.

G. Install each component during weather conditions and Project status that will ensure best possible results. Isolate each part of completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to reduce necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not shown, install individual components at standard mounting heights recognized within the industry or local codes for that application. Refer questionable mounting height decisions to Architect for final decision.

## 3.05 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.

2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

I. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

**3.06 PROGRESS CLEANING**

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Keep site and adjoining streets reasonably clean. If necessary, sprinkle rubbish and debris with water to suppress dust.

E. During handling and installation, protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from soiling, damage, or deterioration until Substantial Completion.

F. Clean and maintain completed construction as frequently as necessary throughout construction period. Adjust and lubricate operable components to ensure ability to operate without damaging effects.

G. Organ Chamber:

1. Clean debris from inside Organ Chamber and leave dust free before organ speakers are installed.

H. Supervise construction activities to ensure that no part of construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

I. Before and during application of painting materials, clear area where such work is in progress of debris, rubbish, and building materials that may cause dust. Sweep floors and vacuum as required and take all possible steps to keep area dust free.

J. Clean exposed surfaces and protect as necessary to avoid damage and deterioration.

K. Place extra materials of value remaining after completion of associated work have become Owner's property as directed by Owner or Architect.

L. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

## 3.07 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

## 3.08 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

## 3.09 FINAL CLEANING

A. Execute final cleaning after Substantial Completion but before making final application for payment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Comply with individual manufacturer's cleaning instructions.

D. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

E. Clean each surface or unit to condition expected in normal, commercial building cleaning and maintenance program, including but not limited to:
   1. Interior Cleaning:
      a. Exercising care not to scratch glass.
      b. Remove marks, stains, fingerprints and dirt.
      c. Clean and polish woodwork and finish hardware.

d. Clean plumbing fixtures and tile work. Remove spots, soil or paint.
e. Clean surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
f. Clean other fixtures and equipment and remove stains, paint, dirt, and dust.
g. Remove temporary floor protection and clean floors.

2. Exterior Cleaning:
   a. Exercising care not to scratch glass.
   b. Remove marks, stains, and dirt from exterior surfaces.
   c. Clean and polish finish hardware.
   d. Remove temporary protection systems.
   e. Clean dirt, mud, and other foreign material from paving and sidewalks.
   f. Clean drop inlets, through-curb drains, and other drainage structures.
   g. Remove trash, debris, and foreign material from landscaped areas.

F. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

G. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

H. Clean filters of operating equipment.

I. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems.

J. Clean site; sweep paved areas, rake clean landscaped surfaces.

K. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

## 3.10 CLOSEOUT PROCEDURES

A. Closeout process consists of three specific project closeout inspections. Contractor shall plan sufficient time in construction schedule to allow for required inspections before expiration of Contract Time.

B. Contractor shall conduct his own inspections of The Work and shall not request closeout inspections until The Work of the contract is reasonably complete and correction of obvious defects or omissions are complete or imminent.

C. Date of Substantial Completion shall not occur until completion of construction work, unless agreed to by Architect and included on Certificate of Substantial Completion.

D. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

E. Preliminary Closeout Review:
   1. When Architect, Owner and Contractor agree that project is ready for closeout, Pre-Substantial Inspection shall be scheduled. Preparation of floor substrate to receive carpeting and any work which could conceivably damage or stain carpet must be completed, as carpet installation will be scheduled immediately following this inspection.
   2. Prior to this inspection, completed test and evaluation reports for HVAC system and font, where one occurs, are to be provided to Project Manager, Architect, and applicable consultants.
   3. Architect and his appropriate consultants, together with Contractor and mechanical, plumbing, fire protection, and electrical sub-contractors shall conduct a space by space

and exterior inspection to review materials and workmanship and to demonstrate that systems and equipment are operational.

a. Punch list of items requiring completion and correction will be created.
b. Time frame for completion of punch list items will be established, and date for Substantial Completion Inspection shall be set.

F. Substantial Completion Inspection:
1. When Architect, Owner and Contractor agree that project is ready for Substantial Completion, an inspection is held. Punch list created at Pre-Substantial Inspection is to be substantially complete.
2. Prior to this inspection, Contractor shall discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups and similar elements.
3. Architect, Owner and Contractor review completion of punch list items. When Owner and Architect confirm that Contractor has achieved Substantial Completion of The Work, Owner, Architect and Contractor will execute Certificate of Substantial Completion that contains:
a. Date of Substantial Completion.
b. Punch List Work not yet completed, including seasonal and long lead items.
c. Amount to be withheld for completion of Punch List Work.
d. Time period for completion of Punch List Work.
e. Amount of liquidated damages set forth in Supplementary Conditions to be assessed if Contractor fails to complete Punch List Work within time set forth in Certificate.
4. Contractor shall present Closeout Submittals to Architect and place tools, spare parts, extra stock, and similar items required by Contract Documents in locations as directed by Facilities Manager.

G. Final Acceptance Meeting:
1. When punch list items except for any seasonal items or long lead items which will not prohibit occupancy are completed, Final Acceptance Meeting is held.
2. Owner, Architect and Contractor execute Owner's Project Closeout - Final Acceptance form, and verify:
a. All seasonal and long lead items not prohibiting occupancy, if any, are identified, with committed to completion date and amount to be withheld until completion.
b. Owner's maintenance personnel have been instructed on all system operation and maintenance as required by the Contract Documents.
c. Final cleaning requirements have been completed.
3. If applicable, once any seasonal and long lead items are completed, Closeout Inspection is held where Owner and Architect verify that The Work has been satisfactorily completed, and Owner, Architect and Contractor execute Closeout portion of the Project Closeout - Final Acceptance form.
4. When Owner and Architect confirm that The Work is satisfactorily completed, Architect will authorize final payment.

## 3.11 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

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**SECTION 01 7419**
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

## PART 1 GENERAL

### 1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

D. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

### 1.02 DEFINITIONS

A. Asphalt Pavement, Brick, and Concrete (ABC) Rubble: Rubble that contains only weathered (cured) asphalt pavement, clay bricks and attached mortar normally used in construction, or concrete that may contain rebar. The rubble shall not be mixed with, or contaminated by, another waste or debris.

B. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

C. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

E. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

F. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

## PART 3 EXECUTION

### 2.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

B. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

C. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.

2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

D. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

E. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

**END OF SECTION**

**SECTION 01 7800**
**CLOSEOUT SUBMITTALS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

D. Maintenance materials.

### 1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 PROJECT RECORD DOCUMENTS

A. Do not use record documents for construction purposes:
   1. Protect from deterioration and loss in secure, fire-resistive location.
   2. Provide access to record documents for Architect's reference during normal working hours.

B. Maintain clean, undamaged set of Drawings:
   1. Mark set to show actual installation where installation varies from the Work as originally shown.
   2. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
   3. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
   4. Mark new information that is important to Owner, but was not shown on Drawings.
   5. Note related Change Order numbers where applicable.

C. As Built Record Drawings:
   1. As required in agreement with the Owner:
      a. Architect will provide two full-size sets of prints of the As Built Record Drawings to the Facilities Management Office, printed from the updated AutoCAD drawing files or updated Revit model files, as specified by Owner, that have been modified to show actual dimensions and location of equipment, material, utility lines, and other work as actually constructed, based upon information provided by Contractor. Architect will submit updated As Built Record Drawings in PDF (ISO32000 format) to Owner.
      b. Architect will submit following:
         1) Updated AutoCAD as built record drawing files with associated plot style tables or Revit as built record model files, as specified by Owner.
         2) Revit Model O&M lifecycle requirements to be tracked by Facility Manager.

D. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.

3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

E. Ensure entries are complete and accurate, enabling future reference by Owner.

F. Store record documents separate from documents used for construction.

G. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

## 3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

E. General:
1. Include closeout submittal documentation as required by Contract Documentation.
2. Include workmanship bonds, final certifications, equipment check-out sheets, and similar documents.
3. Releases enabling Owner unrestricted use of The Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
4. Include Project photographs, damage or settlement survey, and similar record information required by Contract Documents.
5. Submittal Format:
a. Digital copies unless otherwise noted, required for each individual specification section that include ‘Closeout Submittals’.
b. Include only closeout submittals as defined in individual specification section as required in Contract Documents.

F. Project Manual:
1. Copy of complete Project Manual including Addenda, Modifications as defined in General Conditions, and other interpretations issued during construction:
a. Mark these documents to show variations in actual Work performed in comparison with text of specifications and Modifications.
b. Show substitutions, selection of options, and similar information, particularly on elements that are concealed or cannot otherwise be readily discerned later by direct observation.

G. Maintenance Contracts:
1. Digital format only.

H. Operations and Maintenance Data:
1. Digital format only:

a. Cleaning instructions.
b. Maintenance instructions.
c. Operations instructions.
d. Equipment list.
e. Parts list.

I. Warranty Documentation:
1. Digital format of final, executed warranties.

J. Record Documentation:
1. Digital format only.
a. Certificate of Occupancy
b. Certifications.
c. Color and pattern selections
d. Design Data.
e. Geotechnical Evaluation Reports (soils reports).
f. Manufacture Reports.
g. Manufacturer's literature or cut sheets.
h. Shop Drawings.
i. Source Quality Control.
j. Special Procedures.

K. Testing and Inspection Agency Reports.
1. Testing and Inspection Reports.

L. Software:
1. Audio and Video System software, programming and set-files.

M. Irrigation Plan.
1. Laminated and un-laminated reduced sized hard copies.

N. Landscape Management Plan (LMP):
1. Irrigation Section:
a. Submittal Format: Digital format and hard copy of each.
b. Documentation required by sections under 32 8000 Heading: ‘Irrigation’.
2. Landscaping Section:
a. Submittal Format: Digital format and hard copy of each.
b. Documentation required by sections under 32 9000 Heading: ‘Planting’.

**3.03 WARRANTIES AND BONDS**

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers. Provide copy of electronic manual as requested by owner.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

### 3.04 MAINTENANCE MATERIAL SUBMITTALS

A. Submit item(s) required by Section 01 3000 - Administrative Requirements and as defined in individual specification sections if required in Contract Documents. Items may be provided at completion of Work or with Closeout Submittals.

**END OF SECTION**

**SECTION 03 3000**
**CAST-IN-PLACE CONCRETE**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete anchors

C. Concrete foundation walls.

D. Concrete reinforcement.

E. Joint devices associated with concrete work.

F. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.

G. Concrete curing.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

B. Section 03 3517 - Concrete Sealer Finishing

C. Section 03 4500-Precast Concrete Specialties

D. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

E. Section 31 0500 for field applied termiticide and mildewcide for concrete surfaces.

F. Section 32 1313-Concrete Paving: Concrete paving, sidewalks, curbs and gutters.

G. Section 33 1416 - Site Water Utility Distribution Piping for installation of sleeves for piping penetrating interior concrete slabs on grade.

### 1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

C. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

D. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.

E. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

F. ACI PRC-308 - Guide to External Curing of Concrete; 2016.

G. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

H. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

I. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

J. ANSI/NFSI B101.1 - Test Method For Measuring Wet SCOF Of Common Hard-Surface Floor Materials; 2009.

K. ANSI/NFSI B101.3 - Test Method For Measuring Wet DCOF Of Common Hard-Surface Floor Materials; 2012.

L. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

M. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

N. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2021a.

O. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

P. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.

Q. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

R. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

S. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2017.

T. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

U. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.

V. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2023.

W. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

X. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

Y. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.

Z. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

AA. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

BB. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2022.

CC. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.

DD. ASTM C779/C779M - Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces; 2019.

EE. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2016.

FF. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

GG. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

HH. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.

II. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.

JJ. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.

KK. ASTM D471 - Standard Test Method for Rubber Property--Effect of Liquids; 2016a (Reapproved 2021).

LL. ASTM D523 - Standard Test Method for Specular Gloss; 2014 (Reapproved 2018).

MM. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 2011 (Reapproved 2022).

NN. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

OO. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018.

PP. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.

QQ. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2021.

RR. ASTM D5767 - Standard Test Method for Instrumental Measurement of Distinctness-of-Image (DOI) Gloss of Coated Surfaces; 2018.

SS. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a.

TT. 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 2019).

UU. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

VV. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric); 2014.

WW. 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; 2018a.

XX. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs; 2017.

YY. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.

ZZ. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

AAA. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

BBB. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete; 1992.

CCC. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops; 1974.

DDD. COE CRD-C 572 - Handbook for Concrete and Cement Corps of Engineers Specifications for Polyvinylchloride Waterstop; 1974.

EEE. COE CRD-C 621 - Handbook for Concrete and Cement Standard Specification for Packaged, Dry; 1997.

FFF. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.

GGG. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.

HHH. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems; 2014, with Editorial Revision (2017).

III. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

JJJ. NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.

KKK. NSF 372 - Drinking Water System Components - Lead Content; 2022.

## 1.04 SUBMITTALS

A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
2. For chemical-resistant waterstops, provide data on ASTM D471 test results.
3. Printed application instructions for form release agents.

B. Mix Design: Submit proposed concrete mix design.
1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.

C. Shop Drawings:
1. Show dimensioned locations of anchor bolts for hold-down anchors and columns.
2. Show reinforcement and all necessary bending diagrams and reinforcing steel list, and construction joint locations.
3. Provide bar schedules and bending details.
4. Show all formwork for concrete surfaces which are to remain exposed in the finished work.
5. Joint layout plan for control and expansion joints for sidewalks, curbs, and gutters for written approval before starting work on this Section.

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Ready-Mix Supplier:
1. Require mix plant to furnish delivery ticket for each batch of concrete. Keep delivery tickets at job-site for use of Owner or its representatives. Tickets shall show following:
   a. Name of ready-mix batch plant.
   b. Serial number of ticket.
   c. Date and truck number.
   d. Name of Contractor.
   e. Name and location of Project.
   f. Specific class or designation of concrete conforming to that used in Contract Documents.
   g. Amount of concrete.
   h. Amount and type of cement.
   i. Total water content allowed by mix design.
   j. Amount of water added at plant.
   k. Sizes and weights of sand and aggregate.
   l. Time loaded.
   m. Type, name, manufacturer, and amount of admixtures used.
2. Provide certificates with supporting testing reports verifying compliance with Contract Document requirements and that materials provided are from single source for following:
   a. Cement.
   b. Aggregate.
   c. Fly Ash.

F. Test Reports: Submit report for each test or series of tests specified.

G. Test Reports: Submit termite-resistant sheet manufacturer's summary of independent laboratory and field testing for effectiveness in subterranean termite exclusion.

H. Manufacturer's Installation Instructions: For concrete accessories and form release agents, indicate installation procedures and interface required with adjacent construction.

I. Manufacturer’s Reports:
1. Provide Manufacturer's performance and testing data for following:
   a. Each admixture used.

J. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

K. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Record Documentation:
1) Pour Reports:
(a) Provide report that records following information:
(1) Date and time of start of pour, Date and time of end of pour, and Date and time of end of finishing procedures.
(2) Temperature at start of pour, Temperature at end of Pour, and Maximum temperature during performance of finishing procedures.
(3) Wind speed at start of pour, Wind speed at end of pour, and Maximum wind speed during performance of finishing procedures.
(4) Humidity at start of pour, Humidity at end of pour, and High and low humidity during performance of finishing procedures.
(5) Cloud cover at start of pour, Cloud cover at end of pour, and High and low cloud cover during performance of finishing procedures.
(6) Screeding method and equipment used.
(7) Saw cut method and equipment used.
2) Testing and Inspection Reports:
(a) Testing Agency Testing and Inspecting Reports of concrete.
3) Warranty. Submit rapid concrete drying or MVRA manufacturer warranties for concrete moisture vapor emission induced flooring failure and adhesion; ensure both have been completed in project's name and registered with manufacturer.
(a) Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of concrete. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
(b) Provide stand-alone adhesion warranty matching duration of flooring adhesive or primer manufacturer's material defect warranty.

L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.05 DEFINITIONS**

A. Cold Weather, as referred to in this Section, is four (4) hours with ambient temperature below 40 deg F in twenty-four (24) hour period.

B. Floor Flatness (FF): Rate of change in elevation of floor over 12 inches section.

C. Floor Levelness (FL): Measures difference in elevation between two points which are 10 feet apart.

D. Hot Weather, as referred to in this Section, is ambient air temperature above 100 deg F or ambient air temperature above 90 deg F with wind velocity 8 mph or greater.

**1.06 QUALITY ASSURANCE**

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
1. Maintain one copy of each document on site.

B. Qualifications: Requirements of Section 01 4000 applies, but is not limited to following:
1. Installers and Installation Supervisor:
a. ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
b. Certification for National Ready Mixed Concrete Association (NRMCA).
2. Ready-Mix Supplier:
a. Comply with ASTM C94/C94M requirements and be certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities".
3. Testing Agencies:
a. Independent agency qualified according to ASTM C1077 and ASTM E329.

1) Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technicians, Grade I according to ACI CP-1 or equivalent certification program.
2) Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Testing and Inspection:
1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
2. Owner will provide Testing and Inspection on concrete:
a. Owner will employ testing agencies to perform testing and inspection on concrete as specified in Field Quality Control in Part 3 of this specification:
1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.

D. Follow recommendations of ACI PRC-305 when concreting during hot weather.

E. Follow recommendations of ACI PRC-306 when concreting during cold weather.

F. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

G. MANDATORY Pre-Installation Conference:
1. Agenda items, review following:
a. Review Section 01 4000 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
1) Review requirements and frequency of testing and inspections.
b. Set up concrete placement pour card system and verify that all relevant trades have signed off prior to concrete placement.
c. Obtaining trade sign-offs on each pour card will be responsibility of General Contactor's foreman or whoever is in charge of ordering concrete.
d. Pour cards will be turned in to Quality Assurance representative after the work has been completed so that they can be reviewed and filed.
e. Review installation scheduling, coordination, placement of building concrete, and placement of items installed in and under concrete.
f. Review installation scheduling, coordination and placement of site concrete and of items installed in concrete.
g. Review "Verification of Conditions" requirements.
h. Review requirements for preparation of subgrade and aggregate base requirements.
i. Review formwork requirements.
j. Review approved mix design requirements, mix designs and use of admixtures.
k. Review reinforcing bar submittals.
l. Review installation schedule and placement of reinforcing bars.
m. Review placement, finishing, and curing of concrete, including cold and hot weather requirements.
n. Review joint layout plan for control and expansion joints, fillers for sidewalks, curbs, and gutters:
1) Review jointing requirements.
2) Joint layout for concrete paving is specified in Section 32 1313.
o. Review smooth rubbed concrete finish procedures and requirements (applied immediately after removing concrete formwork while concrete is "green").
p. Review layout plan, scheduling, coordination, and placement requirements of detectable warning panels.

q. Review concrete slab tolerances and corrective measures if tolerances not met.
r. Review safety issues.

H. Scheduling:
1. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing concrete.
2. Schedule pre-installation conference prior to placing of footings, installation of foundation forms and reinforcing steel, and installation of anchors, dowels, inserts, and block outs in foundation walls and slabs.

### 1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Slabs with Porosity Inhibiting Admixture (PIA) or Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of the concrete.
1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.

C. Moisture Emission-Reducing Curing and Sealing Compound, Membrane-Forming: Provide warranty to cover cost of flooring delamination failures for 10 years.
1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

D. Moisture Emission-Reducing Curing and Sealing Compound, Penetrating: Provide non-prorated warranty to cover cost of flooring delamination failures for 20 years.
1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

E. Termite-Resistant Vapor Barrier Sheet: Provide five year manufacturer's limited warranty.

## PART 2 PRODUCTS

### 2.01 CONCRETE FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI PRC-347 to provide formwork that will produce concrete complying with tolerances of ACI SPEC-117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
2. Form Facing for Exposed Finish Concrete: Steel.
3. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
a. Vertical earth cuts may be used for footings provided the footing width and length are 6" wider and longer than scheduled.
4. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
5. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

### 2.02 CONCRETE ANCHORS

A. General:
1. Use hot-dipped galvanized or stainless steel with matching nuts and washers in exterior and moist interior applications unless indicated otherwise on Contract Drawings.
a. Install hot-dipped or stainless steel anchor bolts to attach wood sill plates to foundation with 1/4 inch by 3 inch x 3 inch minimum adjustable plate washers and standard cut washers between wood sill plates and nuts.

b. Nut: Conform to requirements of ASTM A563, Grade A, Hex.
c. Conform to requirements of ASTM F3125/F3125M for chemical, physical and mechanical requirements for quenched and tempered bolts manufactured from steel and alloy steel.

2. Threaded rod for adhesive anchors and cast-in anchors:
   a. Conform to requirements of ASTM A307, Grade A or ASTM F1554 Grade 36 unless indicated otherwise on Contract Drawings.
3. Cast-In-Place Anchor Bolts:
   a. J-Bolts:
      1) Non-headed type threaded 2 inches minimum conforming to requirements of ASTM F1554, Grade A.
      2) Anchor hook to project 2 inches minimum including bolt diameter.
   b. Headed Bolts:
      1) Headed type threaded 2 inches minimum conforming to requirements of ASTM F1554, Grade A.
4. Headed Concrete Anchor Studs:
   a. Composed of low carbon steel meeting requirements of ASTM A108.
   b. Tensile Strength: 61,000 psi minimum.
   c. Yield Strength: 49,000 psi minimum.
5. Deformed Bar Anchors:
   a. Manufactured in accordance with requirements of ASTM A1064/A1064M.
   b. Tensile Strength: 80,000 psi minimum.
   c. Yield Strength: 70,000 psi minimum.
6. Reinforcing Bars:
   a. Composed of deformed carbon steel meeting requirements of ASTM A615/A615M, Grade 60 (field bent bars may be Grade 40)
7. Adhesive Anchors:
   a. Products shall have current ESR conforming to current ICC Acceptance Criteria ICC-ES AC308 for concrete.
   b. Rod diameter and embedment length as indicated on Contract Drawings.
   c. Acceptable Products:
      1) HIT-RE 500V3 with SafeSet Epoxy Adhesive by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
      2) Pure 110+ by DeWalt Anchors & Fasteners, Towson, MD, www.anchors.dewalt.com.
      3) SET-3G Epoxy by Simpson Strong-Tie Co., Pleasanton, CA www.strongtie.com.com.
      4) Equal as approved by Architect before installation. See Section 01 6000.
8. Expansion Anchors:
   a. Products shall have current ESR conforming to current ICC Acceptance Criteria ICC-ES AC193 for concrete.
   b. Acceptable Products:
      1) KWIK Bolt TZ2 Expansion Anchor by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
      2) Power-Stud +SD2 by DeWalt Anchors & Fasteners, Brewster, NY, www.ancors.dewalt.com.
      3) Strong-Bolt 2 by Simpson Strong-Tie Co., Pleasanton, CA www.strongtie.com.
      4) Equal as approved by Architect before installation. See Section 01 6000.
9. Screw Anchors:
   a. Provide anchors with length identification markings conforming to ICC Acceptance Criteria ICC-ES AC193 for concrete.
   b. Type Two Acceptable Products:
      1) KWIK KH-EZ by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.

2) Screw-Bolt+ by DeWalt Anhors & Fasteners Inc., Towson, MD, www.anchors.dewalt.com.
3) Titen HD by Simpson Strong Tie Co, Pleasanton, CA www.strongtie.com.
4) Equals as approved by Architect through shop drawing submittal before installation. See Section 01 6000.

**2.03 REINFORCEMENT MATERIALS**

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), except dowels that are to be field bent, Grade 40 minimum.
1. Type: Deformed billet-steel bars.
2. Finish: Unfinished, unless otherwise indicated.
3. Bars shall be free of heavy rust scales and flakes, or other bond-reducing coatings.

B. Epoxy Coated Reinforcement Steel Bars:
1. Bars shall have grade identification marks and conform to ASTM A615/A615M with coating conforming to ASTM A775/A775M and comply with requirements of ACI 318.21.2.5:
a. Bar supports shall be completely coated with epoxy or vinyl, compatible with both concrete and epoxy coating on bars. Coating shall be at least 1/8 inch thick at tips.
b. Tie wire shall be nylon coated.
2. Actual yield strength based on mill tests does not exceed specified yield strength by more than 18,000 psi and Ratio of actual ultimate stress (at breaking point) to actual tensile yield stress shall not be less than 1.25.
a. Grade 60 minimum, except dowels that are to be field bent, Grade 40 minimum.
3. Bars shall be deformed type.
4. Bars shall be free of heavy rust scales and flakes, or other bond-reducing coatings.

C. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
1. Form: Coiled Rolls.
2. WWR Style: 6 x 6 - W1.4 x W1.4..

D. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
2. Bar Supports:
a. Concrete masonry units or bricks are not acceptable.
b. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CSRI, Class 2).
c. Acceptable Products:
1) Concrete 'dobies' or blocks wired to reinforcing.
2) Manufactured chairs with 4 sq inch bearing surface on sub-grade, or other feature to prevent chair from being pushed into sub-grade or damaging vapor retarder under slabs on grade.
3. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
4. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

**2.04 CONCRETE MATERIALS**

A. Performance:
1. Design Criteria: Conform to requirements of ASTM C94/C94M unless specified otherwise:
2. Capacities:
a. For testing purposes, following concrete strengths are required:
1) At 7 days: 70 percent minimum of 28 day strengths.
2) At 28 days: 100 percent minimum of 28 day strengths.

B. Cement: ASTM C150/C150M, Type I - Normal Portland type. Provide _____ manufactured by _____ ..
   1. Acquire cement for entire project from same source.

C. Concrete mix design: Submit mix designs to meet following requirements:
   1. General Purpose Footings and Exterior Concrete:
      a. For general purpose for footings and for exterior concrete (excluding concrete paving, curbs, gutters and waterways) where not subject to freeze/thaw cycles and deicing salts or where higher strength is needed due to soil conditions and as otherwise required by the contract drawings.
      b. 3000 psi (20.68 MPa) minimum at twenty-eight (28) days.
      c. Water / Cementitious Material: 0.45 to 0.50 by weight.
   2. Unexposed Interior Concrete:
      a. For unexposed interior concrete slabs on grade and as otherwise required by the contract drawings.
      b. 3500 psi (24.13 MPa) minimum at twenty-eight (28) days.
      c. Water / Cementitious Material: 0.45 maximum by weight.
   3. Exposed Interior Concrete:
      a. For exposed interior concrete slabs on grade that receive polished floor finishing system and as otherwise required by the contract drawings.
      b. 3500 psi (24.13 MPa) minimum at twenty-eight (28) days.
      c. Water / Cementitious Material: 0.45 maximum by weight.
      d. Drying shrinkage of concrete mix is to be limited to 0.032 percent at twenty-eight (28) days when tested per ASTM C157. Use 1 gal (3.785 liter) of shrinkage reducing admixture per 1 cu yd (0.765 cu m) of concrete.
   4. Foundation Walls and Exterior Concrete:
      a. For foundation walls, exterior concrete paving, curbs, gutters, and waterways not exposed to freeze/thaw cycles and deicing salts and as otherwise required by the contract drawings.
      b. 4000 psi (27.58 MPa) minimum at twenty-eight (28) days.
      c. Water / Cementitious Material: 0.45 maximum by weight.
      d. For concrete paving, use mix design based upon use of 1-1/2 inches coarse aggregate (about 15 percent).
   5. Exterior Concrete Exposed to Freeze/Thaw:
      a. For exterior concrete exposed to freeze/thaw cycles and deicing salts or where soils are "corrosive" and as otherwise required by the contract drawings.
      b. 4500 psi (31.03 MPa) minimum at twenty-eight (28) days.
      c. Water / Cementitious Material: 0.40 maximum by weight.
      d. Use twenty-five (25) percent Class F fly ash as part of cementitious material.
      e. Mix Type E should be used for all exterior concrete exposed to freeze/thaw cycles and deicing salts, unless dictated otherwise by site conditions.
      f. For concrete paving, use mix design based upon use of 1-1/2 inches coarse aggregate (about 15 percent).
   6. Self-Consolidating Concrete (SCC):
      a. Rarely used optional mix type.
      b. Self-consolidating concrete may be used for all architectural concrete, heavily reinforced concrete, concrete for structural repairs, and other members as described in contract documents.
      c. 4000 psi (27.58 MPa) minimum at twenty-eight (28) days.
      d. All self-consolidating concrete shall contain high-range water-reducing admixture and viscosity-modifying admixture where required.
      e. Minimum flow of 20 inches (508 mm) - 30 inches (762 mm) or as required by successful test placement.

f. Workability, pump ability, finish ability, and setting time of mix design shall be verified with successful test placement onsite.
g. Viscosity Modifying Admixture (VMA) shall be used to optimize viscosity of Self-Consolidating Concrete (SCC) at dosage rates per manufacturer's recommendation.

7. Air Entrainment: Six (6) percent, plus or minus 1-1/2 percent for exterior concrete and foundation walls exposed to freeze/thaw cycles.
8. Do not add water any time during mixing cycle above amount required to meet specified water / cement ratio. No reduction in amount of cementitious material is allowed.
9. Mix design strengths specified are a minimum due to exposure to sulfates, chlorides, freeze/thaw, water, etc. Refer to the structural drawings for additional concrete strength requirements. The most stringent requirements should be met.

D. Slump:
1. 4 inch (100 mm) slump maximum before addition of high range water reducer.
2. 8 inch (200 mm) slump maximum with use of high range water reducer.
3. Slump not required for Mix Type G.

E. General:
1. Submit a letter on quarry's letterhead that certifies all aggregate for concrete complies with the requirements of this section. Material certificates which are submitted shall be signed by both the materials producer and the contractor, certifying that materials comply with or exceed requirements specified herein to the Architect, Civil and Structural Engineering Consultant and the Independent Testing Laboratory for review and approval.
2. Aggregates for all concrete shall come from a quarry that is DOT approved and meets or exceeds durability Class I aggregate. The quarry shall submit a letter to Engineer that certifies that all aggregate complies with DOT requirements for durability. Aggregate not meeting DOT durability requirements shall not be used.

F. Fine and Coarse Aggregates: ASTM C33/C33M.
1. Acquire aggregates for entire project from same source.

G. Fly Ash: ASTM C618, Class C or F.
1. Not to exceed twenty-five (25) percent of weight of cementitious materials.

H. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

**2.05 ADMIXTURES**

A. No admixture shall contain calcium chloride nor shall calcium chloride be used as an admixture. All chemical admixtures used shall be from same manufacturer and compatible with each other.
1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Mix design shall show proposed admixtures, amount, usage instructions, and justification for proposed use. Do not use any admixtures without Architect's written approval.
1. Chemical accelerator or retarder may be used if necessary to meet environmental conditions and construction schedules.

C. Alkali-Silica Reactivity Inhibiting Admixture:
1. Specially formulated lithium nitrate admixture for prevention of alkali-silica reactivity (ASR) in concrete. Admixture must have test data indicating conformance to ASTM C1293.
2. Manufacturer: As approved by Architect before use. See Section 01 6000.

D. Viscosity Modifying Admixture (VMA):
1. Liquid admixture used to optimize viscosity of Self-Consolidating Concrete (SCC). Subject to compliance with requirements, provide following at dosage rates per manufacturer's recommendations.
2. Manufacturer: As approved by Architect before use. See Section 01 6000.

E. Air Entraining Admixture: ASTM C260/C260M.
1. Manufacturer: As approved by Architect before use. See Section 01 6000.

F. High Range Water Reducing Admixture: ASTM C494/C494 Type F.
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

G. High Range Water Reducing and Retarding Admixture (Superplasticizer): ASTM C494/C494M Type G.
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

H. Water Reducing Admixture: ASTM C494/C494M Type A.
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

I. Water Reducing and Accelerating Admixture: ASTM C494/C494 Type E.
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

J. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

K. Accelerating Admixture: ASTM C494/C494M Type C.
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

L. Retarding Admixture: ASTM C494/C494M Type B.
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

M. Shrinkage Reducing Admixture: ASTM C494/C494M Type S.
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

N. Non-Chloride, Non-Corrosive Accelerating Admixture: ASTM C494/C494M Type C or E.
   1. Manufacturer: As approved by Architect before use. See Section 01 6000.

O. Corrosion Inhibiting Admixture: ASTM C494/C494M Type C and ASTM C1582/C1582M.
   1. Liquid admixture to inhibit corrosion of steel reinforcement in concrete by introducing proper amount of anodic inhibitor. Admixture shall contain thirty (30) percent calcium nitrite solution and shall be used where called for in specifications or on drawings.
   2. Manufacturer: As approved by Architect before use. See Section 01 6000.

P. Moisture Vapor Reduction Admixture (MVRA):
   1. Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.
   2. Manufacturer: As approved by Architect before use. See Section 01 6000.

Q. Waterproofing Admixture:
   1. Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.
   2. Admixture Composition: Crystalline, functioning by growth of crystals in capillary pores.
   3. Admixture Composition: Hydrophobic polymer waterproofing and corrosion inhibitor, functioning by closing concrete pores and chemical bonding.
   4. Permeability of Cured Concrete: No measurable leakage when tested in accordance with COE CRD-C 48 at 200 psi; provide test reports.
   5. Potable Water Contact Approval: National Science Foundation (NSF) certification for use on structures holding potable water, based on testing in accordance with NSF 61 and NSF 372.
   6. Manufacturer: As approved by Architect before use. See Section 01 6000.

R. Rapid Drying Admixture in Interior Concrete Slabs on Grade:
   1. Admixture specifically designed to promote rapid drying of concrete.
   2. Manufacturer: As approved by Architect before use. See Section 01 6000.

## 2.06 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:
   1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.

2. Thickness: 15 mil minimum
3. Water Vapor Permeance: ASTM E96, Metah A, Perm 0.01
4. Puncture Resistance: ASTM D1709
5. Installation: Comply with ASTM E1643
6. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
7. Manufacturer: As approved by Architect before use. See Section 01 6000.

B. Termite-Resistant Vapor Barrier Sheet: Plastic sheet complying with ASTM E1745, Class C; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs, and for exclusion of subterranean termites.
1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, prefabricated boots, etc., for sealing seams and penetrations.
2. Manufacturers: As approved by Architect before use. See Section 01 6000.

C. Termite-Excluding Underslab Barrier and Waterproofing Membrane: Composite sheet of polyethylene film, termite-excluding barrier sealant, and non-woven polypropylene fabric.
1. Total Thickness: 95 mils (0.095 inch).
2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
3. Water Vapor Permeance: 0.03 perm, maximum, when tested in accordance with ASTM E96/E96M.
4. Accessory Products: Manufacturer's recommended flexible sealant tape, adhesive, mastic, etc., for sealing seams and penetrations.
5. Manufacturers: As approved by Architect before use. See Section 01 6000.

D. Termite-Resistant Barrier Sealant:
1. Solvent-based; single component, no-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.
2. Manufacturers: As approved by Architect before use. See Section 01 6000.

E. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
1. Grout: Comply with ASTM C1107/C1107M.
2. Meet following requirements:
   a. ASTM C1107/C1107M, Type B or Type C.
   b. Corps and Engineers CRD C-621.
   c. Compressive strength of 6000 psi (41 MPa) minimum.
3. Manufacturers: As approved by Architect before use. See Section 01 6000.

F. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator (use on expansion joints of interior slabs on grade of Welfare Services Projects):
1. Composition: High solids content material exhibiting positive expansion when tested in accordance with ASTM C827/C827M.
2. 100 percent solids, two-component, moisture-insensitive, semi-rigid epoxy for use as joint filler for saw cut and tooled interior joints.
3. Self leveling consistency.
4. Shore A Hardness: 75 to 80.
5. Meet following minimum criteria:
   a. Tensile Strength: 600 psi (4.2 MPa).
   b. Ultimate Elongation: 35 percent.
6. Manufacturers: As approved by Architect before use. See Section 01 6000.

G. Semi-Rigid Joint Filler (control joints of interior concrete slabs on grade in warehouse areas of Welfare Services Projects):

## 2.07 BONDING AND JOINTING PRODUCTS

A. Bonding Agents:

1. Manufacturers: As approved by Architect before use. See Section 01 6000.

B. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
   1. Manufacturers: As approved by Architect before use. See Section 01 6000.

C. Waterstops (Contractor Option):
   1. Waterstops: PVC, complying with COE CRD-C 572.
      a. Configuration: As indicated on drawings.
      b. Size: As indicated on drawings.
      c. Manufacturers: As approved by Architect before use. See Section 01 6000.
   2. Waterstops: Bentonite and butyl rubber, complying with NSF 61 and NSF 372.
      a. Configuration: As indicated on drawings.
      b. Size: As indicated on drawings.
      c. Manufacturers: As approved by Architect before use. See Section 01 6000.

D. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   1. Material: ASTM D1751, cellulose fiber.
   2. Manufacturers: As approved by Architect before use. See Section 01 6000.

E. Expansion Joint Filler:
   1. Expansion Joint Filler Material:
      a. Design Criteria:
         1) Resilient, flexible, non-extruding, expansion-contraction joint filler meeting requirements of ASTM D1751 or ASTM D8139.
         2) 1/2 inch (12.7 mm) thick.
         3) Resilience:
            (a) When compressed to half of original thickness, recover to minimum of seventy (70) percent of original thickness.
      b. Manufacturers: As approved by Architect before use. See Section 01 6000.

F. Finishing Material (Exposed Vertical Faces of Foundation and Retaining Walls):
   1. Do not apply finishing material (parge coat) to foundation or retaining walls.

G. Slab Contraction Joint Device (if used): Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
   1. Manufacturers: As approved by Architect before use. See Section 01 6000.

H. Slab Construction Joint Devices (if used and required by contract drawings): Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.
   1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
      a. Height: To suit slab thickness.
      b. Manufacturers: As approved by Architect before use. See Section 01 6000.
   2. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.
      a. Manufacturers: As approved by Architect before use. See Section 01 6000.

## 2.08 CURING MATERIALS

A. Membrane Curing:
   1. Clear water-based, ready-to use membrane curing agent that cures freshly placed concrete, forming effective barrier against moisture loss from concrete surface.
   2. Design Criteria:
      a. Exterior Concrete:
         1) Dissipating or non-dissipating membrane curing agent.
      b. Interior Concrete:
         1) Dissipating membrane curing agent only.
         2) Gradually dissipate after twenty-eight (28) days without leaving stain or discoloring concrete surface.

c. VOC-compliant compound.
d. Meet requirements of ASTM C309 and AASHTO M 148, Type 1 or 1-D, Class B.
e. Interior concrete: containing no mineral spirits, naphtha, or other components detrimental to finish flooring installation.
f. Maintain ninety-five (95) percent of mix water present in concrete mass after application.

3. Horizontal and Vertical Cast-In-Place Structural Concrete:
   a. Acceptable Products.
      1) Exterior Concrete:
         (a) Clear Cure J7WB by Dayton Superior Corporation, Miamisburg. OH www.daytonsuperior.com.
         (b) Clear Water Resin by Right Point, Dekalb, IL www.rightpointe.com.
         (c) L&M Cure R by L&M Construction Chemicals, Inc. Omaha, NE www.lmcc.com.
         (d) VOCOMP 20 (do not use when concrete sealer will be applied in areas of freeze/thaw and deicer salts) by W.R. Meadows, Inc. Hampshire, IL www.wrmeadows.com.
         (e) 1100-Clear by W. R. Meadows, Inc. Hampshire, IL www.wrmeadows.com.
         (f) Equal as approved by Architect before use. See Section 01 67000
      2) Interior Concrete:
         (a) Clear Cure J7WB by Dayton Superior Corporation, Miamisburg. OH www.daytonsuperior.com.
         (b) Clear Water Resin by Right Point, Dekalb, IL www.rightpointe.com.
         (c) L&M Cure R by L&M Construction Chemicals, Inc. Omaha, NE www.lmcc.com.
            (1) 1100-Clear by W. R. Meadows, Inc. Hampshire, IL www.wrmeadows.com.
         (d) Equal as approved by Architect before use. See Section 01 6000.

B. Water Curing:
   1. Required Locations:
      a. Use on polished concrete finishing surfaces in areas as shown on Contract Drawings.
      b. Used on all interior concrete floor surfaces including offices that receive carpet.
      c. Used on concrete surfaces in Process Area, Process Area Custodial Room, and Yard Sales Area only.
      d. Used on concrete surfaces in areas as shown in Contract Documents.
   2. Water-Curing Materials:
      a. Type Two Acceptable Products:
         1) Absorptive Cover: Meet requirements of AASHTO M 182, Class 2 burlap cloth made from jute or kenaf and weighing minimum of 9 oz per sq yd (305 grams per sq m) when dry.
         2) Moisture-Retaining Cover: White, opaque membrane meeting requirements of ASTM C171 minimum.
         3) Equals as approved by Architect before using. See Section 01 6000.

**2.09 MIXING**

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94/C94M.

C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify lines, levels, and dimensions before proceeding with work of this section and before concrete is placed.
   1. Notify Architect of incorrect dimensions or spot elevations in writing.
   2. Do not place concrete until corrections are made and verified.

B. Detectable Warning Panels:
   1. Examine substrate and verify substrate is suitable for installation of detectable warning panels:
      a. Notify Architect of unsuitable conditions in writing.
      b. Do not install detectable warning panels over unsuitable conditions.
      c. 3) Commencement of Work by installer is considered acceptance of substrate.

**3.02 PREPARATION**

A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Concrete Mixing:
   1. General:
      a. All concrete shall be machine mixed.
      b. Water gauge shall be provided to deliver exact predetermined amount of water for each batch.
      c. Reliable system must be employed to insure that no less than predetermined amount of cement goes into each batch.
      d. Re-tempering partly set concrete will not be permitted.
   2. Transit Mix:
      a. Transit mix concrete may be used provided it conforms to Specifications and tests herein described and ASTM C94/C94M.
      b. Central plant producing concrete and equipment transporting it are suitable for production and transportation of controlled concrete and plant is currently approved by local state DOT.
      c. Maximum elapsed time between time of introduction of water and placing shall be one (1) hour.
      d. Minimum time of mixing shall be one (1) minute per cubic yard after all material, including water, has been placed in drum, and drum shall be reversed for an additional two (2) minutes.
      e. Mixing water shall be added only in presence of Inspecting Engineer or inspector employed by Testing Agency.
      f. Trucks shall not be overloaded in excess of rated capacity as recommended by manufacturer.
   3. Cold Weather Concreting Procedures:
      a. General Requirements:
         1) Materials and equipment required for heating and protection of concrete shall be approved and available at Project site before beginning cold weather concreting.
         2) Forms, reinforcement, metallic embedments, and fillers shall be free from snow, ice, and frost. Surfaces that will be in contact with newly placed concrete, including subgrade materials, shall be 35 deg F (2 deg C) minimum at time of concrete placement.
         3) Thaw sub-grade 6 inches (150 mm) deep minimum before beginning concrete placement. If necessary, re-compact thawed material.
         4) Use no frozen materials or materials containing ice.
         5) See ACI 306.1 ‘Standard Specification for Cold Weather Concreting’ for additional requirements.

4. Hot Weather Concreting Procedures:
    a. General:
        1) Maximum concrete temperature allowed is 90 deg F (32 deg C) in hot weather.
        2) Cool aggregate and subgrades by sprinkling.
        3) Avoid cement over 140 deg F (60 deg C).
        4) Use cold mixing water or ice.
        5) Use fog spray or evaporation retardant to lessen rapid evaporation from concrete surface.
        6) See ACI 305.1 ‘Specification for Hot Weather Concreting’ for additional requirements.

E. Surface Preparation:
1. Earthwork Preparation:
    a. Aggregate base and subgrade:
        1) Prepare aggregate base as specified in Section 312323.
        2) Prepare natural soil subgrade as specified in Section 31 2200.
        3) Prepare fill subgrade as specified in Section 31 2323.
2. Concrete Slab Thickness:
    a. Increase thickness of concrete beneath detectable warning panels one inch (25 mm).
3. Inserts, bolts, boxes, templates, pipes, conduits, and other accessories required by Divisions 22, 23, and 26 shall be installed and inspected before placing concrete.
4. Install inserts, bolts, boxes, templates, pipes, conduits, and other accessories furnished under other Sections to be installed as part of work of this Section:
    a. Tie anchor bolts for hold-down anchors and columns securely to reinforcing steel.

F. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
1. Use latex bonding agent only for non-load-bearing applications.

G. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

H. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

I. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

J. Removal:
1. Remove water and debris from space to be placed.
2. Vapor Retarder Over Aggregate Base: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

**3.03 INSTALLATION OF FORMWORK**

A. Forms:
1. Assemble forms so forms are sufficiently tight to prevent leakage.
2. Properly brace and tie forms.
3. Provide temporary cleanouts at base of tall forms if used to facilitate cleaning and inspection.
4. Make proper form adjustments before, during, and after concreting.
5. Use new forms, or used forms that have been cleaned of loose concrete and other debris from previous concreting and repaired to proper condition. Use APA Plyform B-B Class I,

or APA HDO Plyform B-B Class I, on exposed to view concrete that do not receive a smooth rubbed finish.

6. Use metal cold joint forms when unable to place concrete for footings, foundations, and slabs in continuous pours.
7. Provide beveled 2 inch by 4 inch keys where shown on Contract Drawings for tall or heavily loaded walls.

B. Accessories:
   1. General:
      a. Provide for installation of inserts, templates, fastening devices, sleeves, and other accessories to be set in concrete before placing.
      b. Position anchor bolts for hold-down anchors and columns and securely tie in place before placing concrete.
   2. Form Release / Finish Agents:
      a. Film thickness shall be no thicker than as recommended by Manufacturer.
      b. Allow no release / finish agent on reinforcing steel or footings.
   3. Expansion Joints:
      a. Install at joints between floor slab and foundation wall where shown on Drawings.

C. Form Removal (Slab on Grade):
   1. Removal of forms can usually be accomplished in twelve (12) to twenty-four (24) hours.
   2. If temperature is below 50 deg F (10 deg C) or if concrete (stairs, beams, etc) depends on forms for structural support, leave forms intact for sufficient period for concrete to reach adequate strength.
   3. For exposed to view surfaces that receive a smooth rubbed finish, remove forms while concrete is still “green”.
   4. Metal bars or prys should not be used. Use wood wedges, tapping gradually when necessary.

**3.04 PLACING CONCRETE**

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. General:
   1. Place as soon after mixing as possible.
   2. Deposit as nearly as possible in final position.
   3. No concrete shall be deposited in water.
   4. Placing of concrete shall be continuous until panel or section is complete.
   5. Compact concrete in forms by vibrating and other means where required.
      a. Thoroughly consolidate concrete around reinforcing bars (Consolidation not required in concrete around reinforcing bars with Mix Type G).
      b. Use and type of vibrators shall conform to ACI 309.
   6. Form vertical surfaces full depth. Do not allow concrete to flow out from under forms in any degree into landscaped areas.
   7. Consolidate concrete thoroughly.
   8. Do not embed aluminum in concrete.
   9. Do not use contaminated, deteriorated, or re-tempered concrete.
   10. Avoid accumulation of hardened concrete.
   11. Dusting with cement not permitted.

F. Footings:

1. Bear 12 inches (300 mm) minimum into undisturbed earth or on mechanically compacted engineered fill. Step footings at ratio of 1-1/2 horizontal to One vertical unless detailed otherwise.
2. Level top of finish footing and leave rough.
3. Where joints are required, bulkhead, key horizontally, and dowel with two No. 5 reinforcing bars, 48 inches (1 200 mm) long.

G. Foundation Walls: Leave steel projecting where required for floor tie.

H. Interior Slabs:
1. For continuous placing and where shown on Drawings, saw cut one inch (25 mm) deep control joints before shrinkage occurs (2 inches at 6 inch slabs) (50 mm at 150 mm slabs).
    a. Do not install control joints where Drawings indicate they are not to be installed.

I. Exterior Slabs:
1. For continuous placing and where shown on Drawings, saw cut one inch (25 mm) deep control joints before shrinkage occurs (2 inches at 6 inch slabs) (50 mm at 150 mm slabs).

J. Miscellaneous Concrete Elements:
1. Detectable Warning Panels:
    a. Follow Manufacturer's recommendations on following:
        1) Temperature requirements.
        2) Expansion and control joint requirements.
        3) Installation of panels.
        4) Curing of panels.
2. Equipment Bases: Coordinate with appropriate Sections for locations and dimensions.
3. Light Pole Bases, Mow Strips, and Aprons:
    a. Install bond breaker consisting of three (3) layers of 30 lb (13.6 kg) roofing felt between pole base and adjoining sidewalk, mow strip and building foundations, and aprons and building foundations.
4. Mow Strips and Aprons:
    a. Aggregate base not necessary under mow strips and aprons.
    b. Form and cast mow strips in place.
    c. Elevations:
        1) Refer to Section 32 9122-Topsoil Grading for relation of finish grades to top of mow strip elevations.
        2) Refer to Civil Drawings for top of apron elevations.
    d. Compact topsoil underneath mow strips and aprons to density of undisturbed earth.
5. Pipe Bollards:
    a. Install plumb and fill with concrete.
6. Sidewalks, Exterior Stairs, And Landings:
    a. Slope with cross slope of 1/8 to 1/4 inch per ft (3 to 6 mm per 300 mm) (one to two percent) in direction of intended drainage.
    b. Slope away from building 1/8 to 1/4 inch per ft (3 to 6 mm per 300 mm) (one to two percent) minimum.
    c. Concrete walks shall be screeded to bring surface to grades and lines as indicated.
    d. Surface shall be floated with wood float with no coarse aggregate showing and then given broom finish before concrete sets.

K. Vertical Surfaces:
1. Retaining Walls, Exposed Foundations, etc:
    a. Finish provided by form release / finish agent specified.
    b. Repair of Unacceptable Concrete.
2. Immediately after removing forms, remove joints, marks, bellies, projections, loose materials, and cut back metal ties from surfaces to be exposed.
3. Point up voids with cement mortar, 1:2 mix, and rub exposed surface with carborundum to smooth, even surface matching surrounding undamaged area.

4. Light Pole Bases: Exposed portion to have rubbed finish.

L. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

M. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

**3.05 SLAB JOINTING**

A. Locate joints as indicated on drawings (do not use control joints in interior concrete slabs in meetinghouse).
   1. Concrete Control Joints on Center Spacing.
      a. Sidewalks: 4-6 feet
      b. Curbs and Gutters: 10 feet
      c. Mow Strips: 3-5 feet.
      d. Flat Drainage Structures: 10 feet.
      e. Retaining Walls with guardrails: Align with posts.
      f. Retaining Walls with Fencing: Align with posts.
   2. Concrete Expansion Joint (isolation) Joints on Center Spacing.
      a. Sidewalks, Curbs and Gutters: 40-100 feet
      b. Mow Strips and Aprons: 20-40 feet.
      c. Flat Drainage Structures: 50 feet.
      d. Retaining Walls with guardrails: 36 feet.
      e. Retaining Walls with Fencing: 50 feet.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

F. Contraction Joint Devices: Use preformed joint device, with top set flush with top of slab.

G. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

H. Seal expansion joints as specified in Section 07 9200 for following areas:
   1. Between entryway slabs and building foundations.
   2. Between sidewalks and building foundations.
   3. Concrete retaining walls.
   4. Within curbs and gutters.
   5. Within flat drainage structures and at joints between flat drainage structures and other concrete elements.

I. Expansion joints are not required to be sealed for following areas:
   1. Within aprons and where apron abuts sidewalks.
   2. Within mow strips and where mow strip abuts building foundation and sidewalks.
   3. Within sidewalks.

**3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES**

A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for compliance with specified tolerances.

B. Correct the slab surface if tolerances are less than specified.

C. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
   1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.
   2. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.
   3. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

D. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

E. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

F. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

**3.07 CONCRETE FINISHING**

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, immediately after form removal.

D. Interior Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Screed Concrete.
   2. Float Finish:
      a. Float as soon after screeding as possible.
      b. Consolidate surface with power-driven floats with exception of areas inaccessible to power-driven floats, which may be hand-floated.
      c. Re-straighten, cutting down high spots and filling low spots.
      d. Repeat float passes and re-straightening until surface has uniform, smooth, granular texture.
      e. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
   3. Trowel Finish:
      a. Steel trowel slab after concrete has set enough to avoid bringing water and fines to surface.
      b. Perform troweling with power-driven trowels with exception of areas inaccessible to power-driven trowels, which may be hand-troweled.
      c. Continue troweling passes and re-straightening with 10 foot (3 meter) highway straightedge until surface is free of trowel marks and uniform in texture and appearance.
      d. Apply burnished, burned-out trowel finish.
      e. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
   4. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.

5. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

F. Concrete Polishing: See Section 03 3511.

**3.08 CURING AND PROTECTION**

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than seven days.
   2. High early strength concrete: Not less than four days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by membrane curing, water ponding, water-saturated sand, water-fog spray, or saturated burlap.
   2. Slabs and Floors To Receive Adhesive-Applied Flooring: Membrane Cure. Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
   3. Slabs and Floors to Receive Polished Finish: Water cure
   4. Final Curing: Begin after initial curing but before surface is dry.
      a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
      b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

**3.09 POST INSTALLED ANCHORS**

A. General:
   1. Drill holes with rotary impact hammer drills using carbide-tipped bits.
   2. Unless otherwise shown on Drawings, drill holes perpendicular to concrete surface.
   3. Perform anchor installation in accordance with Manufacturer’s published instructions.

B. Adhesive Anchors:
   1. Clean holes in accordance with Manufacturer’s published instructions before installation of adhesive:
      a. Follow Manufacturer’s recommendations to ensure proper mixing of adhesive components.
   2. Adhesive:
      a. Inject adhesive into holes proceeding from bottom of hole and progressing toward surface so as to avoid introduction of air pockets into adhesive.
      b. Inject sufficient adhesive into hole to ensure that annular gap is filled to surface.
      c. Remove excess adhesive from surface and threads of anchor as necessary.
   3. Shim anchors with suitable device to center anchor in hole. Do not disturb or load anchors before Manufacturer’s specified cure time has elapsed.
   4. Temperature:
      a. Observe Manufacturer’s recommendations with respect to installation temperatures for adhesive anchors.
      b. Base material temperatures must be maintained above minimum temperatures allowed by Manufacturer for full required epoxy cure time.

C. Expansion Anchors:
   1. Protect threads from damage during anchor installation and prior to use.
   2. Set anchors to Manufacturer's recommended torque, using a torque wrench. Following attainment of ten (10) percent of specified torque, one hundred (100) percent of specified torque shall be reached within 7 or fewer complete turns of nut. If specified torque is not achieved within required number of turns, remove and replace anchor, unless otherwise directed by Architect.

D. Screw Anchors:
   1. Protect threads from damage during anchor installation and prior to use.
   2. Set anchor flush, collared.
   3. Do not exceed Manufacturer's maximum allowed torque when seating anchor.

**3.10 NON-SHRINK GROUTING**

A. Surface Preparation:
   1. Prepare concrete surfaces in accordance with Manufacturer's written instructions:
   2. Remove all loose materials.
   3. Clean surface of any substance that could interfere with bond on material including dirt, paint, tar, asphalt, wax, oil, grease, latex compounds, form release agents, laitance, loose toppings, foreign substances and any other residues.
   4. Saturate area to be grouted with water in accordance with Manufacturer's written instructions.

B. Mixing:
   1. Mix grout in accordance with Manufacturer's written instructions.
   2. Add mix water in amount in accordance with Manufacturer's written instructions to provide required placing consistency.
   3. Do not add water in amount that will cause bleeding or segregation of mixed grout.
   4. Do not add any sand, cement, admixtures, or fluidifiers to grout.

C. Placement:
   1. Place grout in accordance with Manufacturer's written instruction including but not limited to the following:
      a. Proper curing is required.
      b. Use cold weather or hot weather grouting procedures in accordance with Manufacturer's written instructions, as temperature dictates:
         1) Do not use at temperatures that may cause premature freezing.
         2) Do not allow to freeze until 4000 psi (27.6 MPa) is attained.
      c. Employ cold weather or hot weather grouting practices as temperatures dictates.
   2. Completely eliminate air pockets and provide full contact between grout and item being grouted. Do not exceed Manufacturer's recommended thickness.

D. Curing:
   1. Cure grout in accordance with Manufacturer's written instructions or ACI curing practices.
   2. Wet cure grout until forms are removed.
   3. Seal grout surfaces after forms are removed as recommended by Manufacturer.

E. Keep grout surfaces wet after curing compound has dried for as long as recommended by Manufacture.

F. Protect placed grout from freezing until minimum strength of 4000 psi (27.58 MPa) is reached.

G. Protect placed grout from damage during construction.

**3.11 FIELD QUALITY CONTROL**

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Quality Control is sole responsibility of Contractor.

1. Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
    a. Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.

C. Provide free access to concrete operations at project site and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

E. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

F. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

G. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

H. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

I. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

J. Permeability Test: Test concrete with waterproofing admixture according to COE CRD-C 48.

K. Precast Concrete:
    1. Testing Agency shall provide inspection including following:
        a. Review all precast plant test reports.
        b. Provide inspection of all precast during construction, transportation, and erection, verifying precast is undamaged, and installed in accordance with requirements of Contract Documents.
        c. Provide inspection of precast concrete anchorages to other components of structure.

L. Expansion Anchors / Adhesive Anchors / Screw Anchors:
    1. Certified Inspector from Testing Agency shall verify procedures used for installation of all concrete anchors and monitor their installation for compliance with Manufacturer's requirements.
    2. Inspections:
        a. Inspections shall include required verification and inspection of anchors as referenced in IBC Table 1704.4 and in accordance with most current version of ACI 318 or ACI 318M and applicable ASTM material standards that:
            1) The correct rod/anchor is used; size and type.
            2) The correct hole size is used and prepared per Manufacturer's instructions.
            3) That climactic conditions, and concrete temperature, allow for the anchors' installation and use.
            4) Proper hole cleaning equipment, per Manufacturer's instructions, is used.
            5) Torque applied to anchors does not exceed Manufacturer's allowable limits.
                (a) Torque applied to anchors is per Manufacturer's instructions.

## 3.12 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

### 3.13 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

B. Protect installed products from damage during construction.

**END OF SECTION 03 3000**

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**SECTION 03 4500**
**PRECAST ARCHITECTURAL CONCRETE**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Architectural precast concrete accessories.

B. Supports, anchors, and attachments.

C. Grouting under panels.

### 1.02 REFERENCE STANDARDS

A. ACI 301 - Specifications for Concrete Construction 2020.

B. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

G. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric) 2021a.

H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.

I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.

J. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

K. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

L. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

N. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products 2013.

O. PCI MNL-120 - PCI Design Handbook 2017, with Errata (2021).

P. PCI MNL-122 - Architectural Precast Concrete: Fully Revised Manual Including New Sections, Extensive Updates, and Detailed Specifications to Meet Today's Construction Needs. 2007.

Q. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete 1988.

R. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction 2000.

### 1.03 SUBMITTALS

A. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

B. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, integral insulation, insulated panel system connectors, connection details,

support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.

1. Include details of mix designs.
2. Include structural design calculations.

C. Samples: Submit two, __6__by__6__ inch in size, illustrating surface finish, color and texture.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

D. Mark units with date of production in location that will be concealed after installation.

## PART 2 PRODUCTS

### 2.01 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.

1. Concrete Face Mix: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent; comply with ACI 301.
2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
3. Calculate structural properties of units in accordance with ACI 318.
4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

B. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

### 2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi).

1. Deformed billet-steel bars.

B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.

### 2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Other Cementitious Materials:

C. Fine and Coarse Structural Aggregates: ASTM C33/C33M.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

E. Air Entrainment Admixture: ASTM C260/C260M.

F. Grout:

1. Non-shrink, non-metallic, minimum 10,000 psi, 28 day strength.

### 2.04 SUPPORT DEVICES

A. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.

1. Clean surfaces of rust, scale, grease, and foreign matter.

2. Prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.
3. Galvanize after fabrication in accordance with requirements of ASTM A123/A123M.

B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563/A563M nuts and matching washers.

## 2.05 FABRICATION

A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.

B. Maintain plant records and quality control program during production of precast units. Make records available upon request.

C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

D. Maintain consistent quality during manufacture.

E. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

F. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

G. Install window units in place while fabricating precast units. Protect assembly from damage.

H. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

I. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

J. Remove protective coating from thin brick using method recommended by manufacturer. Do not damage brick or concrete material in joints.

## 2.06 FABRICATION TOLERANCES

A. Comply with PCI MNL-117 and PCI MNL-135, except as specifically amended below.
1. Maximum Variation From Nominal Face Dimensions: Plus or minus 3/32 in.
2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet.
3. Maximum Variation from Thickness: Plus or minus 1/8 in.
4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
5. Maximum Bowing of Members: Plus or minus length/360.

## 2.07 ACCESSORIES

A. General:
1. Chamfered edges.
2. Smooth finish free from pits and rock pockets.

B. Concrete Amortizement.
1. Color: Similar to brick.
2. Provide cast-in drip edge as shown on Contract Documents.

C. Splash Blocks:
1. 16 inches (400 mm) wide by 24 inches (600 mm) long by 3 inches (75 mm) high.
2. Formed water trough.
3. Cast in reinforcing mesh.

D. Window Sills:
1. Provide cast-in anti-drip groove.
2. Provide minimum of two (2) mounting dowels for each sill.
3. Provide cast-in anti-drip groove.

E. Window Headers, Window Sills, Water Table/Column Ledgers:
   1. See Contract Documents for pre-cast sizes.
   2. Provide cast-in anti-drip groove.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

### 3.02 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

### 3.03 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.

E. Fasten units in place with mechanical connections.

F. Weld units in place. Perform welding in accordance with AWS D1.1/D1.1M.

G. Provide non-combustible shields during welding operations.

H. Touch-up field welds and scratched or damaged primed painted surfaces.

I. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.

J. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances.

### 3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135, except as specifically amended below.
   1. Plan Location from Building Grid Datum: Plus or minus 3/8 in.
   2. Top Elevation from Nominal Top Elevation: Plus or minus 3/8 inch.
   3. Maximum Plumb Variation Over Height of Structure or 100 ft (whichever is less): Plus or minus 1/2 inch.
   4. Exposed Joint Dimension: Plus or minus 3/16 inch.
   5. Maximum Jog in Alignment of Matching Faces or Edges: Plus or minus 3/16 inch.
   6. Differential Bowing or Camber as Erected Between Similar Adjacent Members: Plus or minus 3/16 inch.

### 3.05 CLEANING

A. Clean.

B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

### 3.06 PROTECTION

A. Protect installed components from subsequent construction operations.

B. Do not permit traffic over unprotected floor surface.

**END OF SECTION**

**SECTION 04 2000**
**UNIT MASONRY**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement, anchors, inserts and anchorage.

D. Accessories.

### 1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.

B. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

### 1.03 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 355.4 - Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary; 2020.

C. ACI 548.12 - Specification for Bonding Hardened Concrete and Steel to Hardened Concrete with an Epoxy Adhesive; 2012.

D. ASCE 5 - Building Code Requirements and Specification for Masonry Structures; 2011.

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

I. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2021a.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

K. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

M. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2019.

N. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

O. ASTM C331/C331M - Standard Specification for Lightweight Aggregates for Concrete Masonry Units; 2017.

P. ASTM C34 - Standard Specification for Structural Clay Loadbearing Wall Tile; 2017.

Q. ASTM C55 - Standard Specification for Concrete Building Brick; 2017.

R. ASTM C56 - Standard Specification for Structural Clay Nonloadbearing Tile; 2013 (Reapproved 2017).

S. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2017.

T. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2021.

U. ASTM C73 - Standard Specification for Calcium Silicate Brick (Sand-Lime Brick); 2017.

V. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2022.

W. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units; 2022.

X. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

Y. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

Z. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

AA. ASTM C212 - Standard Specification for Structural Clay Facing Tile; 2022.

BB. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2022.

CC. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

DD. ASTM C315 - Standard Specification for Clay Flue Liners and Chimney Pots; 2007 (Reapproved 2021).

EE. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.

FF. ASTM C476 - Standard Specification for Grout for Masonry; 2022.

GG. ASTM C530 - Standard Specification for Structural Clay Nonloadbearing Screen Tile; 2013 (Reapproved 2017).

HH. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale); 2022.

II. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2021.

JJ. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.

KK. ASTM C1261 - Standard Specification for Firebox Brick for Residential Fireplaces; 2013, with Editorial Revision (2017).

LL. ASTM C1283 - Standard Practice for Installing Clay Flue Lining; 2015 (Reapproved 2021).

MM. ASTM C1405 - Standard Specification for Glazed Brick (Single Fired, Brick Units); 2020a.

NN. ASTM C1634 - Standard Specification for Concrete Facing Brick and Other Concrete Masonry Facing Units; 2020.

OO. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.

PP. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.

QQ. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2018.

RR. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

SS. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

TT. ASTM D2287 - Standard Classification System and Basis for Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds; 2019.

UU. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).

VV. 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 2019).

WW. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

XX. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

YY. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

ZZ. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

AAA. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

BBB. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.

CCC. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.

DDD. ICC-ES AC58 - Acceptance Criteria for Adhesive Anchors in Masonry Elements; 2015.

EEE. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.
   1. Conduct conference at Project site.
   2. Schedule pre-installation conference during construction of mockup panel.
   3. In addition to agenda items specified in Section 01-3100, review following:
      a. Review storage and handling requirements.
      b. Review cold and hot weather procedure requirements.
      c. Review Section 01-4000 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections.
         1) Review requirements and frequency of testing and inspections.
         2) Review specific testing and inspections and field test requirements.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, masonry accessories, and post-installed anchors.
   1. Source Quality Control Submittals:
      a. Manufacturer's certification that units meet compressive strength specified requirements.
   2. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
   3. Provide current Manufacturer’s applicable ICC ESR Evaluation Reports and ICC ES Acceptance Criteria showing conformance for each item.

a. Manufacturer's published installation instructions for each item.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
   1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.

D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

E. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

F. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Testing and Inspection Reports:
            (a) Testing Agency Testing and Inspection Reports.

## 1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Scheduling:
   1. Structural Masonry and Post Installed Drilled Anchors:
      a. Notify Testing Agency and Architect twenty-four hours minimum before placing masonry units, reinforcing, mortar and/or grout or installing post installed drilled anchors.
      b. Inspections shall be performed according to Manufacturer’s submitted ICC ES Evaluation Reports.

## 1.07 MOCK-UPs

A. Construct a masonry wall as a mock-up panel sized 4 feet long by 3 feet high; include mortar, accessories, structural backup, flashings (with lap joint, corner, and end dam), and any specialty details, such as reveals, soldier courses, window details, expansion joints if required on Project, flexible flashing and required components at foundation, and seismic reinforcing in mock-up.
   1. Sample panel(s) shall be constructed using ‘production run’ material to be used on Project unless otherwise approved in writing by Architect and/or Owner.
   2. Sample panel(s) are to be used as standard of comparison for masonry work built of same material.
   3. Sample panel(s) shall remain at jobsite until all masonry is completed.
   4. Do not start work until Architect has accepted sample panel(s).
   5. At Architect's direction, demolish mock-ups and remove debris.

B. Locate where directed.

C. Mock-up may remain as part of work.

## 1.08 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered in original, unopened packages with labels intact.

B. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

C. Storage and Handling Requirements:
   1. Aggregate:

a. Store different aggregates separately.
b. Store on high ground, or ideally, off ground to prevent contamination from dirt, organic materials and ground water, any of which may contribute to efflorescence and may be deleterious to mortar performance.
c. Store under protective cover to avoid saturation and freezing in cold weather.

2. Cementitious material:
   a. Store in such manner as to prevent deterioration or intrusion of foreign material or moisture.
   b. Do not use cementitious materials that have become contaminated.
   c. Protect from precipitation and groundwater.
      1) Store materials on elevated platforms, under cover, and in dry location.
      2) Do not use cementitious materials that have become damp or has become unsuitable for good construction.
3. Masonry accessories:
   a. Store masonry accessories clear of ground, including metal items, to prevent corrosion and contamination by dirt and ground water which may contain soluble salts and other matter which may contribute to efflorescence and staining.
   b. Plastic and asphalt coated flashing material should not be stored in areas exposed to sunlight. During installation, flashing must be pliable so that no cracks occur at corners or bends.
   c. Protect from damage until installation.
4. Masonry units:
   a. Store materials protected from exposure to harmful weather conditions as directed by manufacturer.
   b. Store material on planks clear of ground which may contain soluble salts and protect from damage, dirt, or disfigurement.
   c. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof membrane, securely tied. If units become wet, do not install until they are dry.
5. Masonry Reinforcement:
   a. Protect reinforcement, ties, and metal accessories from permanent distortions, elements and store off ground.

D. Store materials protected from exposure to harmful weather conditions and as directed by manufacturer.

## PART 2 PRODUCTS

### 2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
1. Design Criteria:
   a. Minimum Compressive Strength of (2000 psi 13.8 MPa).
2. Materials:
   a. Meet requirements of ASTM C90, lightweight classification:
   b. 85 lbs per cu ft (1 362 kg per cu meter) minimum weight classification.
   c. Lightweight aggregates conforming to ASTM C331/C331M.
   d. Do not use re-crushed masonry units as aggregate.
   e. Outside Corners: Square-edged, except where bull nose is indicated on Contract Drawings.
   f. Use special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, etc, as required.

g. Uniform color and textures with unbroken edges. Smooth face, except where shown otherwise on Contract Drawings.

## 2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C94/C94M, ASTM C150/C150M, Type I; color as required to produce approved color sample.
   1. Not more than 0.60 percent alkali.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C144, ASTM C404 and ASTM C476

E. Admixtures:
   1. Use no admixtures without Architect's written permission. Use of any admixture to meet cold weather requirements and admixtures that increase air entrainment are expressly forbidden under all circumstances.

F. Antifreeze Compounds:
   1. No antifreeze liquids, salts or other substances shall be used in grout to lower freezing point.

G. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Use only in combination with masonry units manufactured with integral water repellent admixture.
   2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
   3. Meet or exceed performance specified for water repellent admixture used in masonry units.

H. 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. Color: Standard gray.

I. Provide grout that conforms to requirements of ASTM C476 and TMS 602/ACI 530.1/ASCE 6.

J. Water: Clean and potable, free of acids, alkalis, and organic materials.

## 2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; galvanized

B. Cold-drawn steel conforming to ASTM A1064/A1064M.
   1. Continuous Joint Reinforcing:
      a. Conform to ASTM A1064/A1064M. Exterior wall reinforcing shall be galvanized to meet requirements of ASTM A153/A153M, Class B-2. Interior wall reinforcing shall be galvanized to meet requirements of ASTM A1064/A1064M, Class A.
      b. Size: 2 inches less than nominal thickness of wall.
      c. Rod Size:
         1) Side rods: 9 gauge (1.48 inch) or 3/16 inch diameter.
         2) Cross rods: 9 gauge or 3/16 inch diameter.
      d. Cross rods that serve as metal ties in exterior cavity and other multi-wythe walls shall be drip crimped.
      e. Corners and Tee Sections: Prefabricated of material and design similar to main reinforcement.
   2. Finish: Hot-dipped galvanized as per ASTM A153/A153M (1.5 oz/ft² after fabrication).

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss or ladder.
   2. Description:
      a. Prefabricated reinforcement for embedment in horizontal mortar joints if required by Contract Drawings.
   3. Acceptable Products. See Section 016200:
      a. No. 120 Truss-Mesh by Hohmann & Barnard.

E. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss.
   2. Where bed joints of wythes align, use joint reinforcing extending across wythes.
      a. Prefabricated joint reinforcement for embedment in horizontal mortar joints tying multiwythe masonry walls together.
   3. Where bed joints of wythes do not align, use:
      a. Acceptable Products. See Section 016200:
         1) No. 170-2X S.I.S. Truss Eye-Wire Adjustable Truss Eye-Wire w/2X-Hook &
   4. Seismiclip Interlock System by Hohmann & Barnard.
      a. No. 270-2X-SH Ladder adjustable reinforcement with 2X-Seismic Hook by Hohmann & Barnard.

F. Accessories:
   1. Rebar Positioners (Used with structural CMU construction):
      a. Design Criteria:
         1) Position rebar vertically in cell of CMU.
         2) Cold-drawn steel conforming to ASTM A1064/A1064M.
         3) Wire diameter: 9 gauge (1.48 inch or 3.7 mm).
         4) Finish: Hot-dipped galvanized as per ASTM A153/A153M (1.5 oz/ft (42.5 grams/305 mm).
      b. Class One Quality Standards:
         1) Single Curtain: No. RB Rebar Positioners by Hohmann & Barnard.
         2) Double Curtain: No. RB-Twin Rebar Positioners by Hohmann & Barnard.
      c. Type Two Acceptable Manufacturers. See Section 016200:
         1) Heckman Building Products Inc, Chicago, IL www.heckmannbuildingprods.com.
         2) Hohmann & Barnard, Hauppauge, NY www.h-b.com.
         3) Masonry Reinforcing Corporation of America, Charlotte, NC www.wirebond.com.
         4) Equal meeting Design Criteria as approved by Architect before installation. See Section 016200.

## 2.04 ANCHORS AND INSERTS

A. Manufactured Units:
   1. General:
      a. Use hot-dipped galvanized or stainless steel with matching nuts and washers in exterior and moist interior applications unless indicated otherwise on Drawings.
      b. Nut: Conform to requirements of ASTM A563, Grade A, Hex.
      c. Conform to requirements of ASTM F3125/F3125M for chemical, physical and mechanical requirements for quenched and tempered bolts manufactured from steel and alloy steel.

B. Embedded Anchor Bolts:

1. Quality Standard. See Section 01 6000.
    a. Meet following design criteria requirements:
        1) Bent-bar Anchors: J and L-Bolts (threaded steel rods with hooks embedded into masonry):
            (a) Non-headed type threaded 2 inches (50 mm) minimum conforming to material requirements of ASTM A36/A36M.
            (b) Anchor hook to project 2 inch (50 mm) minimum including bolt diameter.
        2) Headed Bolts:
            (a) Headed type threaded 2 inch (50 mm) minimum conforming to requirements of ASTM A307, Grade A.

C. Post Installed Drilled Anchors (Concrete Masonry Unit (CMS) and Hollow Brick Unit Masonry):
    1. Design Criteria:
        a. Design loads are determined from testing minimum of five (5) specimens in accordance with ASTM E488/E488M under stresses and conditions that represent intended use.
            1) Allowable stress design values are limited to twenty (20) percent of average tested anchor bolt strength.
            2) Using strength design provisions, nominal design strengths are limited to sixty-five (65) percent of average tested strength.
        b. Effective embedment length: 2 inch (50 mm) minimum.
    2. Adhesive Anchors:
        a. Cartridge Injection Adhesive Anchors.
        b. Products shall have current ICC ES Evaluation report conforming to current ICC ES Acceptance Criteria ICC-ES AC58 for masonry.
        c. Rod diameter and embedment length as indicated on Contract Drawings.
        d. Acceptable Products:
            1) HIT-HY 270 by Hilti Fastening Systems, Tulsa, OK; www.us.hilti.com.
            2) SET ET-3G by Simpson Strong-Tie Co., Pleasanton, CA www.strongtie.com.
            3) Equal as approved by Architect before installation. See Section 01 6000.
    3. Drilled-In Mechanical Anchors (Expansion Bolts):
        a. Products shall have current ICC ES Evaluation report conforming to current ICC ES Acceptance Criteria ICC-ES AC01 for masonry.
        b. Acceptable Products:
            1) Kwik Bolt TZ2 by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
            2) Strong Bolt 2 by Simpson Strong-Tie Co., Pleasanton, CA www.strongtie.com.
            3) Equal as approved by Architect before installation. See Section 01 6000.
    4. Screw Anchors:
        a. Provide anchors with length identification markings conforming to ICC-ES AC106 for masonry.
        b. Acceptable Products:
            1) Titen HD by Simpson Strong Tie Co, Dublin, CA www.strongtie.com.
            2) Hilti KH-EZ by Hilti Fastening Systems, Tulsa, OK, www.us.hilti.com
            3) Equal as approved by Architect through shop drawing submittal before installation. See Section 01 6000.

## 2.05 ACCESSORIES

A. Preformed Control Joints: Rubber or Polyvinyl chloride material. Provide with corner and tee accessories, fused joints.
    1. Design Criteria:

a. Extruded Rubber:
1) Meet requirements of ASTM D2000 2AA-805.
b. PVC:
1) Meet requirements of ASTM D2287 (Type PVC 654-4) with durometer hardness of 85 (+ or -5) when tested in accordance with ASTM D2240.

2. Manufacturers:
a. Hohmann & Barnard, Inc; RS or VS: www.h-b.com/#sle.

B. Preformed Expansion Joints: Closed Cell Neoprene; material without tear strip placed horizontally beneath relieving angle, or in vertical expansion joint to act as control joint. Provide with corner and tee accessories, fused joints.

1. Design Criteria:
a. Extruded Rubber:
1) Meet requirements of ASTM D1056 Grade 2A1.

2. Manufacturers:
a. Hohmann & Barnard, Inc NS neoprene sponge

C. Cleaning Solution:

1. Acceptable Products:
a. 202 or 202V by Diedrich Technologies, Oak Creek, WI www.diedrichtechnologies.com.
b. Surekleen No. 600 or Vana-Trol by ProSoCo Inc, Kansas City, KS www.prosoco.com.
c. Equal as approved by Architect before use. See Section 01 6000.

## 2.06 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Property Specification.

1. Masonry below grade and in contact with earth: Type M.
2. Exterior, loadbearing masonry: Type S
3. Exterior, non-loadbearing masonry: Type S
4. Interior, loadbearing masonry: Type S.
5. Interior, non-loadbearing masonry: Type O.

B. Grout for Unit Masonry: 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.

1. Grout proportions shall be determined by one of the following methods:
a. As per ASTM C476 Table 1: 'Grout proportions by Volume" for fine and coarse grout.
b. Specified Compressive Strength: Proportions established by twenty-eight (28) day compressive strength tests in accordance with Test Method ASTM C1019 that obtain specified compressive strength:
c. Grout shall be mixed to slump of 8 to 11 inches as determined by Test Method ASTM C143 and shall have minimum compressive strength of 2000 psi at 28 days.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. 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.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Verification of Masonry Anchor and Insert Conditions:
   1. Post Installed Anchors (Concrete Masonry Unit (CMS) and Hollow Brick Unit Masonry):
      a. Base Material Strength:
         1) Unless otherwise specified, do not drill holes in masonry until mortar, or grout has achieved full design strength.
      b. Identify position of reinforcing steel and other embedded items before drilling holes for anchors.
      c. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items.
      d. Take precautions as necessary to avoid damaging, electrical and telecommunications conduit, and gas lines.
      e. Notify Architect/Engineer if reinforcing steel or other embedded items are encountered during drilling.

E. Notify Architect of any unsatisfactory preparation before proceeding.
   1. Do not install masonry over unsuitable conditions.
   2. Commencement of Work by installer is considered acceptance of substrate.

**3.02 PREPARATION**

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
   1. Clean surfaces prior to installation.
   2. Prepare surface in accordance with Manufacturer's written instructions.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Coordinate placement of reinforcement, anchors and accessories, flashings and weep holes and other moisture control products specified in other sections.

D. Prior to placing masonry:
   1. Clean reinforcement by removing mud, oil, or other materials that will adversely affect or reduce bond at time mortar or grout is placed.
   2. Remove laitance, loose aggregate, and anything else that would prevent mortar from bonding to foundation.

E. Wetting Masonry Units:
   1. Concrete masonry:
      a. Do not wet concrete masonry units before laying. Wet cutting is permitted.

F. Reinforcement:
   1. Place reinforcement and ties in grout spaces prior to grouting.

G. Provide temporary bracing during installation of masonry work:
   1. Design, provide, and install bracing that will assure stability of masonry during construction.
   2. Maintain bracing in place until building structure provides permanent support.

**3.03 COLD AND HOT WEATHER REQUIREMENTS**

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

B. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

C. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

## 3.04 MASONRY 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.
   3. Mortar Joints: Concave.

## 3.05 PLACING MASONRY UNITS, REINFORCING 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, except for units laid in stack bond.

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. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

L. Interface with Other Work:
   1. Masonry Cutting:
      a. Make cuts proper size to accommodate work of other trades.
      b. Cut openings for electrical devices using cover plates no larger than can be covered by standard size plate.
      c. Replace unit masonry in which larger than necessary openings are cut.
      d. Do not patch openings with mortar or other material.

M. Mortar:
   1. Use mortar within two (2) hours of initial mixing. Discard mortar that has begun to set. Set masonry units within one (1) minute of spreading mortar.
   2. Do not allow mortar build-up in cavity between brick veneer and Concrete Masonry Units (CMU).

N. Laying Masonry Units:
   1. Layout:
      a. Running bond except where indicated otherwise.
   2. Joints:

a. Tool concave. Fill completely except where indicated differently.
b. Do not tool until mortar has taken initial set.
c. Point holes in joints. Fill and tool properly.

3. Concrete Masonry Units:
   a. Lay hollow masonry units dry. Do not lay masonry on frozen material.
   b. Place hollow units so:
      1) Face shells of bed joints are fully mortared.
      2) Webs are fully mortared in all courses of piers, columns and pilasters and when necessary to confine grout or insulation.
      3) Head joints are mortared, minimum distance from each face equal to face shell thickness of unit.
      4) Vertical cells to be grouted are aligned and unobstructed openings for grout are provided in accordance with Contract Drawings.
   c. Align cells or cavities to preserve unobstructed cavity for grouting:
      1) Foamed Insulation:
         (a) Provide unobstructed cavity for foamed-in-place insulation installed in cells.
         (b) Install in ungrouted cells in exterior walls.
      2) Do not allow excess mortar to block cells.
      3) Full bedding required on both webs and face shell under first course. Other courses need only face shell bedding except where bedding is needed to control flow of grout.

O. Reinforcing:
   1. Reinforcing shall be free of material that may destroy bond.
   2. Continuous Joint Reinforcing:
      a. Single-Wythe Unit Masonry:
         1) Beginning approximately 8 inches (200 mm) from base of masonry, provide joint reinforcing 16 inches (400 mm) on center vertically, except 8 inches (200 mm) on center if drip crimped unless noted otherwise by Contract Drawings.
      b. Multi-Wythe Unit Masonry
         1) Maximum offset between brick and block coursing is 1-1/4 inch (32 mm) using ladder adjustable-wire reinforcement or ladder adjustable-wire reinforcement with seismic hook type reinforcing. If brick and block coursing is exactly lined up, ladder adjustable-wire reinforcing may be used. However, such reinforcing may not be bent to fit coursing that does not line up. Space joint reinforcing at 16 inches on center unless noted otherwise by Contract Drawings.
      c. Lap splices and intersections minimum of 6 inches (150 mm).
      d. Ensure that all ends of longitudinal wire of joint reinforcement at laps are embedded in mortar or grout.
   3. Reinforcing Bars:
      a. Fabrication:
         1) Fabricate and bend steel reinforcing bars according to 'ACI Detailing Manual' (2004 edition or latest available) and as detailed on Contract Drawings.
         2) Reinforcement:
            (a) Fabricate reinforcing bars in accordance with fabricating tolerances of ACI 117.
            (b) Bend bars cold and do not heat bars.
            (c) Do not bend Grade 40 bars in excess of 180 degrees. Minimum inside diameter of bend is five bar diameters.
            (d) Minimum inside bend diameter for other bars is as follows:

(1) No. 2 through No. 8 (M #10 through M #25): 6 bar diameters.
(2) No. 9 through No. 11 (M #29 through M #36): 8 bar diameters.

b. Provide standard hooks that conform to following:
   1) Standard 180-degree hook: 180-degree bend plus minimum extension of 4 bar diameters or 2-1/2 inch (64 mm), whichever is greater.
   2) Standard 90-degree hook: 90-degree bend plus minimum extension of 12 bar diameters.
   3) For stirrups and tie hooks for No. 5 (M #l6) bar and smaller: 90-degree or 135-degree bend plus minimum of 6 bar diameters or 2-1/2 inch (64 mm), whichever is greater.

c. Placing Reinforcement Bars:
   1) Place reinforcing and dowels before pouring grout.
   2) Place reinforcement in accordance with the sizes, types, and locations indicated on Contract Drawings and as specified.
   3) Do not place dissimilar metals in contact with each other.
   4) Dowel vertical reinforcing bars out of structure below with bars of same size and spacing e. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond allowable tolerances.
   5) Unless accepted by Architect, do not bend reinforcement after it is embedded in grout or mortar.
   6) Completely embed reinforcing bars in grout in accordance with 'Grout Placement' as specified in Installation requirements in Part 3 of Section 040501: 'Common Masonry Requirements'.
   7) Dowel vertical reinforcing bars out of structure below with bars of same size and spacing.
   8) Maintain clear distance between reinforcing bars and interior of masonry unit or formed surface of at least 1/4 inch (6.4 mm) for fine grout and 1/2 inch (12.7 mm) for coarse grout, d. Place reinforcing bars maintaining the following minimum cover:
      (a) Masonry face exposed to earth or weather:
         (1) 2 inch (50.8 mm) for bars larger than No. 5 (M #16).
      (b) 1-1/2 inch (38.1 mm) for No. 5 (M #16) bars or smaller.
   9) Maintain minimum clear distance between parallel bars of the nominal bar size or 1 inch (25.4 mm), whichever is greater.
   10) In columns and pilasters, maintain minimum clear distance between vertical bars of one and one-half times nominal bar size or 1-1/2 inch (38.1 mm), whichever is greater.
   11) Continue bond beam units and reinforcement uninterrupted around corners and across wall intersections. See Contract Drawings.

d. Splicing:
   1) Splice 48 bar diameters minimum, unless noted otherwise by Contract Drawings.
   2) Noncontact lap splices: Position bars spliced by noncontact lap splice no farther apart transversely than one-fifth specified length of lap nor more than 8 inch (200 mm).

e. Rebar Positioners:
   1) Before grouting, secure masonry reinforcing steel in place before grouting with rebar positioners at top of first course and bottom of top course minimum.
   2) Install intermediary positioners for every 192 bar diameters maximum between positioners.

3) Locate intermediary positioners with approximately equidistant spacing in wall when number required has been determined.

f. Place horizontal bars in 8 inch (200 mm) deep bond beam units at top of wall and at 48 inches (1 200 mm) on center between unless noted otherwise by Contract Drawings. Continue bond beam units and reinforcement uninterrupted around corners and across wall intersections.

g. Place special vertical bars of same size as normal vertical reinforcement at corners and jambs of openings and recesses where bond beams are interrupted and at beam bearing locations not otherwise detailed.

h. Unless detailed otherwise, place special horizontal bars of same size as normal reinforcing above and below openings. Extend bars 24 inches (600 mm) minimum beyond opening.

P. Grouting:

1. General:
   a. Provide grout that conforms to requirements as specified in Section 04 0516: 'Masonry Grouting'.
   b. Use fine grout for cavities 2 inches (50 mm) and smaller in smallest dimension. Use coarse grout for cavities greater than 2 inches (50 mm) in smallest dimension.
   c. Grout hollow metal door frames installed in masonry walls solid.
   d. Provide grout-leveling bed for support of wall plates.
   e. Fully grout cells containing reinforcing bars. Place and consolidate grout fill without displacing reinforcing.
2. Production Methods: Grout shall be produced using one of following procedures:
   a. Materials mixed at job site:
      1) Individual cementitious materials and aggregates stored at job site shall be mixed in mechanical mixer for minimum of five (5) minutes with sufficient water to achieve desired consistency.
      2) Individual dry ingredients transported to job site in suitable compartments shall be mixed with water at job site using continuous volumetric proportioning equipment to achieve desired consistency. Mix with auger of appropriate length to provide adequate mixing.
   b. Mixed materials transported to job site:
      1) Factory dry-blended cementitious materials and aggregates delivered to job site shall be mixed in mechanical mixer for minimum of five (5) minutes with sufficient water to achieve desired consistency.
      2) Wet-mixed grout shall arrive at job site in ready-mixed condition. Slump shall be adjusted as necessary, and grout shall be re-mixed at mixing speed for at least one minutes before discharging to achieve desired consistency.
   c. Grout may be hand mixed on small jobs with written approval of mixing procedure by Architect.
3. Placing time:
   a. Place grout within 1-1/2 hours of introducing water in the mixture and prior to initial set:
      1) Discard site-mixed grout that does not meet specified slump without adding water after initial mixing.
      2) For ready-mixed grout:
         (a) Addition of water is permitted at time of discharge to adjust slump.
         (b) Discard ready-mixed grout that does not meet specified slump without adding water, other than water that was added at time of discharge.
         (c) Time limitation is waived as long as ready-mixed grout meets specified slump.

4. Confinement:
    a. Confine grout to areas indicated on Contract Drawings. Use material to confine grout that permits bond between masonry units and mortar.
5. Grout Pour Height:
    a. Place grout in 48 inch (1 200 mm) maximum lifts.
6. Consolidation:
    a. Consolidate grout at time of placement in by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred
7. Grout Key:
    a. When grouting, form grout keys between grout pours. Form grout keys between grout lifts when first lift is permitted to set prior to placement of subsequent lift:
    b. Form grout key by terminating grout minimum of 1-1/2 inch (38 mm) below mortar joint.
    c. Do not form grout keys within beams.
    d. At beams or lintels laid with closed bottom units, terminate grout pour at bottom of beam or lintel without forming grout key.

Q. Embedded items and accessories:
1. Install embedded items and accessories as follows:
    a. Construct chases as masonry units are laid.
    b. Install pipes and conduits passing horizontally through masonry partitions.
    c. Place pipes and conduits passing horizontally through piers, pilasters, or columns.
    d. Place horizontal pipes and conduits in and parallel to plane of walls.
    e. Install and secure connectors, flashing, weep holes, weep vents, nailing blocks, and other accessories.
    f. Provide control joints and expansion joints as shown on Contract Drawings.
    g. Aluminum:
        1) Do not embed aluminum conduits, pipes, and accessories in masonry, grout, or mortar, unless they are effectively coated or isolated to prevent chemical reaction between aluminum and cement or electrolytic action between aluminum and steel.

## 3.06 ANCHORS AND INSERTS

A. Embedded Anchor Bolts:
1. Embed Headed and J Bolts larger than 1/4 inch (6.4 mm) diameter in grout that is placed in accordance with ‘Grout Placement’ as specified in Installation requirements in Part 3 of this specification. Anchor bolts of 1/4 inch (6.4 mm) diameter or less are permitted to be placed in grout.
2. For anchor bolts placed in top of grouted cells and bond beams, maintain clear distance between bolt and face of masonry unit of at least 1/4 inch (6.4 mm) when using fine grout and at least 1/2 inch (12.7 mm) when using coarse grout.
3. For anchor bolts placed through face shell of hollow masonry unit, drill hole that is tight-fitting to bolt or provide minimum clear distance:
4. For portion of bolt that is within grouted cell, maintain clear distance between bolt and face of masonry unit and between head or bent leg of bolt and formed surface of grout of at least 1/4 inch (6.4 mm) when using fine grout and at least 1/2 inch (12.7 mm) when using course grout.
5. Place anchor bolts with clear distance between parallel anchor bolts not less than nominal diameter of anchor bolt, nor less than 1 inch (25 mm).

B. Post Installed Drilled Anchors (Concrete Masonry Unit (CMS) and Hollow Brick Unit Masonry):
1. General:

a. Drill holes with rotary impact hammer drills using carbide-tipped bits or core drills using diamond core bits.
b. Unless otherwise shown on Contract Drawings, drill holes perpendicular to masonry surface.
c. Where anchors are to be installed in cored holes, use core bits with matched tolerances specified by Manufacturer. Cores holes may only be used if acceptable to Manufacturer.
d. Perform anchor installation in accordance with Manufacturer's published instructions.

2. Adhesive Anchors:
a. Clean holes in accordance with Manufacturer's published instructions before installation of adhesive. Follow Manufacturer's instructions to ensure proper mixing of adhesive components.
b. Inject adhesive into holes proceeding from bottom of hole and progressing toward surface so as to avoid introduction of air pockets into adhesive. Inject sufficient adhesive into hole to ensure that annular gap is filled to surface.
c. Remove excess adhesive from surface.
d. Shim anchors with suitable device to center anchor in hole. Do not disturb or load anchors before Manufacturer's specified cure time has elapsed.
e. Observe Manufacturer's instructions with respect to installation temperatures for adhesive anchors. Base material temperatures must be maintained above minimum temperatures allowed by Manufacturer for full required epoxy cure time.

3. Drilled-in Mechanical Anchors (Expansion Bolts):
a. Protect threads from damage during anchor installation.
b. Set anchors to Manufacturer's recommended torque, using torque wrench. Following attainment of ten (10) percent of specified torque, one hundred (100) percent of specified torque shall be reached within 7 or fewer complete turns of nut. If specified torque is not achieved within required number of turns, remove and replace anchor, unless otherwise directed by Architect.

4. Screw Anchors:
a. Protect threads from damage during anchor installation.
b. Set anchors to Manufacturer's recommended torque, using torque wrench.

**3.07 CONTROL AND EXPANSION JOINTS**

A. Do not continue horizontal joint reinforcement through control or expansion joints, unless noted otherwise by Contract Drawings.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

E. Form expansion joint as detailed on drawings.

**3.08 BUILT-IN WORK**

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

## 3.09 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Alignment of Columns: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

I. Maintain 3/8 inch mortar joints throughout.

J. Grout space or cavity width, except for masonry walls passing framed construction: minus 1/4 inch (6.4 mm), plus 3/8 inch (9.5 mm).

K. Reinforcing Bars:
   1. Place horizontal and vertical reinforcing bars in walls and flexural elements within tolerance of +- 1/2 inches when:
   2. Distance from centerline of reinforcing bars to opposite face of masonry is equal to 8 inches or less.
      a. +- 1 inch for centerline of reinforcing bars to opposite face of masonry is equal to 24 inches or less but greater than 8 inches.
      b. +- 1-1/4 inch for centerline of reinforcing bars to opposite face of masonry is greater than 24 inches.
   3. Place vertical reinforcing bars within:
      a. 2 inch of required location along length of wall when wall segment length exceeds 24 inches.
      b. 1 inch of required location along length of wall when wall segment length does not exceed 24 inches.
   4. If it is necessary to move bars more than one (1) bar diameter, or distance exceeding tolerance stated above, to avoid interference with other reinforcing steel, conduits, or embedded items, notify Architect for acceptance of resulting arrangement of bars.
   5. Foundation dowels that interfere with unit webs are permitted to be bent to maximum of 1 inch horizontally for every 6 inch of vertical height.

## 3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in 01 4000 - Quality Requirements:
   1. Quality Control is sole responsibility of Contractor.
      a. Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
         1) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.

C. Unit Masonry:

1. Masonry (Masonry Prisms, Masonry Units, Reinforcement, Mortar and Grout):
    a. Testing and Inspections shall conform to IBC Section 17 'Special Inspections And Tests' and in accordance with Chapter 3 'Quality And Construction' of TMS 402/ACI 530.1/ASCE 5 (Building Code Requirements for Masonry Structures) and TMS 602/ACI 530.1/ASCE 6 (Specification for Masonry Structures):
        1) Quality assurance program shall comply with requirements of Chapter 3, for Level A 'Quality Assurance' for Risk Category I, II, or III structures or Level B 'Quality Assurance' for Risk Category IV structures and as defined in ASCE 7 or latest approved adopted building code. See Structural Design Criteria as shown on Contract Documents.
    b. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
    c. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

D. Post Installed Drilled Anchor and Insert Tests:
    1. Certified Inspector from Testing Agency shall verify procedures used for installation of all post installed anchors and monitor their installation for compliance with manufacturer's requirements.
    2. Testing: Ten (10) percent of each type and size of drilled-in anchor shall be proof loaded by Testing Agency's testing laboratory or as directed by Architect. Adhesive anchors will not be torque tested unless otherwise directed by Architect. If more than ten (10) percent of tested anchors fail to achieve specified torque or proof load within limits defined on Drawings, all anchors of same diameter and type as failed anchors shall be tested at Contractor's expense, unless otherwise instructed by Architect.
        a. Torque will be applied with calibrated torque wrench.
        b. Proof loads will be applied with calibrated hydraulic ram. Displacement of adhesive anchors at proof load shall not exceed D/10, where D is nominal anchor diameter.
    3. Non-Conforming Work:
        a. Remove and replace defective material at Architect's direction and at no additional cost to Owner.
        b. Remove and replace misplaced or malfunctioning anchors.
        c. Fill empty anchor holes and patch failed anchor locations with high-strength, non-shrink, nonmetallic grout acceptable to Architect.
        d. Anchors that fail to meet proof load or installation torque requirements will be regarded as malfunctioning.
        e. Repair damage to adjacent materials caused by product installation.

E. Inspection, sampling and testing of masonry materials in enclosure walls is not required.

## 3.11 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

E. Waste Management:
    1. Unit Masonry:
        a. Clean up masonry debris and remove from site.

## 3.12 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Cold Weather Requirements:
   1. In cold weather, all materials and walls should be properly protected against freezing including storing of materials, preparation of mortar, heating of masonry units, laying precautions, and protection of Work.
   2. Remove all masonry deemed frozen or damaged.

**END OF SECTION 04 2000**

**SECTION 04 2613**
**MASONRY VENEER**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Clay facing brick.

B. Mortar

C. Reinforcement and anchorage.

D. Flashings.

E. Installation of lintels.

F. Accessories.

### 1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

### 1.03 REFERENCE STANDARDS

A. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2022b.

D. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction 2022.

E. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2021.

F. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.

G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.

H. ASTM C150/C150M - Standard Specification for Portland Cement 2020.

I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.

J. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) 2022.

K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.

L. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars 2018a.

M. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2017).

N. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.

O. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls 2005.

P. BIA Technical Notes No. 46 - Maintenance of Brick Masonry 2017.

Q. DFARS 252.225-7008 - Restriction on Acquisition of Specialty Metals 2022.

R. DFARS 252.225-7009 - Restriction on Acquisition of Certain Articles Containing Specialty Metals 2022.

S. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2022.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section; require attendance by all relevant installers.
   1. Conduct conference at Project site.
   2. Schedule pre-installation conference during construction of mockup panel.
   3. In addition to agenda items specified in Section 01-3100, review following:
      a. Review storage and handling requirements.
      b. Review cold and hot weather procedure requirements.
      c. Review Section 01-4523 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections.
         1) Review requirements and frequency of testing and inspections.
         2) Review specific testing and inspections and field test requirements.

## 1.05 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

B. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.
   1. Provide sample of type of veneer tie used.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturers Documentation:
            (a) Brick Manufacturer's literature or cut sheet.
            (b) Brick color and type selection.
         2) Testing and Inspection Reports:
            (a) Testing Agency Testing and Inspecting Reports.

## 1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Scheduling:
   1. Brick Veneer Unit Masonry:
      a. Structural Mortar:
         1) Notify Testing Agency and Architect twenty-four (24) hours minimum before placing masonry units, reinforcing and mortar.

## 1.07 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 4 feet long by 3 feet high; include mortar and accessories, structural backup, anchor and tie systems, any specialty details, such as reveals, soldier courses, window details, etc., brick expansion joints if required on Project, flexible flashing and required components at foundation, and seismic reinforcing in mock-up.
   1. Sample panels(s) shall be constructed using 'production run' material to be used on Project unless otherwise approved in writing by Architect and/or Owner.

2. Sample panel(s) are to be used as standard of comparison for masonry work built of same materials.
3. Sample panel(s) shall remain at jobsite until all masonry is completed.
4. Do not start work until Architect has accepted sample panel(s).
5. At Architect's direction, demolish mock-ups and remove debris.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

**1.08 DELIVERY, STORAGE, AND HANDLING**

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Storage and Handling Requirements:
1. Aggregate:
   a. Store different aggregates separately.
   b. Store on high ground, or ideally, off ground to prevent contamination from dirt, organic materials and ground water, any of which may contribute to efflorescence and may be deleterious to mortar performance.
   c. Store under protective cover to avoid saturation and freezing in cold weather.
2. Cementitious material:
   a. Store in such manner as to prevent deterioration or intrusion of foreign material or moisture.
   b. Do not use cementitious materials that have become contaminated.
   c. Protect from precipitation and groundwater.
      1) Store materials on elevated platforms, under cover, and in dry location.
      2) Do not use cementitious materials that have become damp or has become unsuitable for good construction.
3. Masonry accessories:
   a. Store masonry accessories clear of ground, including metal items, to prevent corrosion and contamination by dirt and ground water which may contain soluble salts and other matter which may contribute to efflorescence and staining.
   b. Plastic and asphalt coated flashing material should not be stored in areas exposed to sunlight. During installation, flashing must be pliable so that no cracks occur at corners or bends.
   c. Protect from damage until installation.
4. Masonry units:
   a. Store materials protected from exposure to harmful weather conditions as directed by manufacturer.
   b. Store material on planks clear of ground which may contain soluble salts and protect from damage, dirt, or disfigurement.
   c. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof membrane, securely tied. If units become wet, do not install until they are dry.
5. Masonry Reinforcement:
   a. Protect reinforcement, ties, and metal accessories from permanent distortions, elements and store off ground.

C. Store materials protected from exposure to harmful weather conditions and as directed by manufacturer.

## PART 2 PRODUCTS

### 2.01 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBX, Grade SW.
   1. Color and Texture: RED BLEND HAMPTON - NO TEXTURE.
   2. Nominal Size: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long modular brick.
      a. Brick shall be true to size and shape. No warped brick permitted. Brick for Project shall be fired in same run.
   3. Efflorescence:
      a. Provide brick that has been tested according to ASTM C67/C67M and is rated 'Not Effloresced'.
   4. Initial rate of absorption: Less than 30 sq. in (30 g) per minute when tested per ASTM C67/C67M.

### 2.02 MORTAR MATERIALS

A. Masonry Cement: ASTM C91/C91M Type N or Type S if over three stories.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable, free of acids, alkalis, and organic materials.

G. Admixtures:
   1. Use no admixtures, except for color pigments, without Architect's written permission. Use of any admixture to meet cold weather requirements and admixtures that increase air entrainment are expressly forbidden under all circumstances.
   2. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

H. Antifreeze Compounds:
   1. No antifreeze liquids, salts or other substances shall be used in grout to lower freezing point.

I. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Use only in combination with masonry units manufactured with integral water repellent admixture.
   2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
   3. Meet or exceed performance specified for water repellent admixture used in masonry units.

J. 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. Color: Standard gray.
   2. Mixing: Use mechanical batch mixer and comply with referenced standards.

### 2.03 REINFORCEMENT

A. Cold-drawn steel conforming to ASTM A1064/A1064M.

1. Continuous Joint Reinforcing:
    a. Conform to ASTM A1064/A1064M. Exterior wall reinforcing shall be galvanized to meet requirements of ASTM A153/A153M, Class B-2. Interior wall reinforcing shall be galvanized to meet requirements of ASTM A1064/A1064M, Class A.
    b. Size: 2 inches less than nominal thickness of wall.
    c. Rod Size:
        1) Side rods: 9 gauge (1.48 inch) or 3/16 inch diameter.
        2) Cross rods: 9 gauge or 3/16 inch diameter.
    d. Cross rods that serve as metal ties in exterior cavity and other multi-wythe walls shall be drip crimped.
    e. Corners and Tee Sections: Prefabricated of material and design similar to main reinforcement.
2. Finish: Hot-dipped galvanized as per ASTM A153/A153M (1.5 oz/ft² after fabrication).
3. Space joint reinforcing consisting of a single #9 rod at 16" on center beginning at 8" above the foundation.

B. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
3. Vertical adjustment: Not less than 3-1/2 inches.
4. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.
5. Space anchors at 16 inches horizontally and no more than 16 inches on center vertically.
6. Brick Veneer Unit Masonry Attached to Framing:
    a. Brick Ties:
        1) Design Criteria:
            (a) Sheet Metal (Carbon Steel):
            (b) Meet requirements of ASTM A1008/A1008M.
            (c) Provide seismic notch to accommodate 9 ga (3.8 mm) or 3/16 inch (4.8 mm) diameter continuous wire c) Thickness: 14 ga (1.9939 mm).
            (d) Finish: Hot dipped galvanized (ASTM A153/A153M, Class B-2).
            (e) Tie Length: Length includes cavity air space and 1-1/2 inches (38 mm) brick overlap as per code.
        2) Acceptable Products:
            (a) 360 L-Type Seismic Anchor by Heckmann.
            (b) 345 SV Seismic-Notch Veneer Anchor by Hohmann & Barnard.
            (c) 2522 Seismic Veneer Anchor by Wire-Bond.
7. Brick Veneer Unit Masonry With Exterior Rigid Insulation Attached to Framing:
    a. Brick Ties:
        1) Design Criteria:
            (a) Finish: Hot dipped galvanized (ASTM A153/A153M, Class B-2).
            (b) Length: Total length includes cavity air space, exterior rigid insulation and 1-1/2 inches (38 mm) brick overlap as per code.
        2) Acceptable Products:
            (a) HB-213-2X w/300-C Seismic Clip by Hohmann & Barnard.

(b) Concrete 2-Seal Tie Veneer Anchor by Hohmann & Barnard.
(c) Concrete Thermal 2-Seal Tie Veneer Anchor by Hohmann & Barnard.
(d) Equals meeting Design Criteria as approved by Architect before installation. See Section 016200.

b. Fasteners:
1) Quality Standards. See Section 016200:
(a) Wood Framing: Non-corrosive wood screws of length, type, and quantity recommended by Manufacturer.
(b) Steel Framing: Non-corrosive screws of length, type, and quantity recommended by Manufacturer.

8. Dovetail Anchor And Slot:
a. Design Criteria:
1) Finish:
(a) Hot-dipped galvanized as per ASTM A153/A153M (1.5 oz/ft² (458 g/m²)).
b. Dovetail Anchor:
1) Acceptable Products. See Section 016200:
(a) 303-SV Corrugated Notch by Hohmann & Barnard.
(b) 2222 Dovetail Anchor Seismic by Wire-Bond.
(c) Equals meeting Design Criteria as approved by Architect before installation. See Section 016200.
c. Dovetail Slot:
1) Acceptable Products. See Section 016200:
(a) 305 Dovetail Slot by Hohmann & Barnard.
(b) 1304 Dovetail Slot by Wire-Bond.
(c) Equals meeting Design Criteria as approved by Architect before installation. See Section 016200.

## 2.04 FLASHINGS

A. Design Criteria:
1. General:
a. Compatible with sealants and other building components.
b. Do not use as an exposed flashing.
c. Drool: Membrane shall not 'drool' when exposed to UV or heat.
2. Required Components:
a. Drip Edge/Plate: Install with stainless steel drip edge/plate.
b. Mortar Guard: Install with mortar guard.
c. Termination Bar: Install termination bar.
d. Weep Vents: Requires weep vents.
3. Self-adhering and self-sealing membranes:
a. Ambient Conditions: Follow Manufacturer recommendations for storage and application.
b. Do not apply to moist or damp surfaces.
c. Meet testing requirements of ASTM D903 for peel or stripping strength of adhesive bonds.

B. Metal Flashing Materials:
1. Copper Flashing: ASTM B370, 060 soft annealed; 20 oz/sq ft thick; natural finish.

2. Stainless Steel Flashing: Type 304, ASTM A240/A240M, DFARS 252.225-7008, DFARS 252.225-7009

C. Combination Non-Asphaltic Flashing Materials - Copper:
   1. Copper/Polymer Film or Fabric Flashing: 5 oz/sq ft copper sheet laminated between two sheets of polymer or fiberglass fiber-reinforced film.
      a. Manufacturers:
         1) York Manufacturing, Inc; Multi-Flash 500 Series: www.yorkmfg.com.
         2) Cop-R-Kraft Duplex by Advanced Building Products.
         3) Copper-Tuff by Hohmann & Barnard.
         4) Cop-R-Tex Duplex (for coping, door and window heads, roof flashing, curtain wall and flashing between new and old walls) by York.

D. Combination Non-Asphaltic Flashing Materials - Stainless Steel:
   1. Stainless steel core with one uncoated (bare) stainless steel face (outward facing) with a butyl block co-polymer adhesive (inward facing).
      a. Manufacturers:
         1) York Manufacturing, Inc: York 304 SS, www.yorkmfg.com.
         2) Illinois Products, Inc.; IPCO Self-Adhesive Stainless Steel
         3) STS Coatings, Inc.; Wall Guardian Self Adhering Stainless Steel Flashing
         4) TK Products, Inc.; TK Self-Adhering Stainless Steel TWF
         5) Vapro Shield, Inc.; VaproThru-Wall Flashing SA

E. Preassembled Systems:
   1. Description:
      a. Pre-assembled panels consist of flashing membrane, drainage mat with integrated weep tabs, termination bar, drip edge, inside/outside corner boots, and end dams for a complete system.
   2. Acceptable Product:
      a. Total Flash by Mortar Net.
      b. Flash-Vent by York.

F. Termination Bars: Stainless steel; compatible with membrane and adhesives.

G. Drip Edge/Plate:
   1. Design Criteria:
      a. 26 ga (0.019) (0.4826 mm) stainless steel AISI Type 304 drip edge/plate flashing with drip edge hemmed back.
   2. Acceptable Products:
      a. No. 1007 Hemmed Drip-Edge Flashing by Heckmann.
      b. Drip Plate by Hohmann & Barnard.
      c. Sandell's Drip Edge by Sandell Construction Solutions.
      d. No. 4156 Drip Edge Flashing by Wire-Bond.

H. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

## 2.05 ACCESSORIES

A. Weeps:
   1. Description:
      a. Allows passage of moisture from cavity to building exterior while restricting ingress of insects and other debris.

b. Dimensions:
1) 3/8 inch (9.5 mm) wide x 2-1/2 inch (64 mm) deep x 3-3/8 inch (86 mm) long.
2. Design Criteria:
a. Polypropylene tested to conform to ASTM standards.
b. Suitable for top of wall venting.
c. Acceptable Products:
1) Cell Vent:
(a) QV - Quadro-Vent by Hohmann & Barnard.
(b) No. 3601 Cell Vent by Wire-Bond.

B. Vents (Open Head Joints):
1. Description:
a. Vent inserted in weep hole at top of drainage air space in full height masonry veneer walls (not required in veneer wainscot walls or if air space vents into structure/roof above wall).
b. Vent allows passage of moisture from cavity to building exterior while restricting ingress of insects and other debris.
2. Dimensions:
a. 3/8 inch (9.5 mm) wide x 2-1/2 inch (64 mm) deep x 3-3/8 inch (86 mm) long.
3. Design Criteria:
a. Polypropylene tested to conform to ASTM standards.
b. Suitable for top of wall venting.
4. Acceptable Products:
a. Cell Vent:
1) QV - Quadro-Vent by Hohmann & Barnard.
2) No. 3601 Cell Vent by Wire-Bond.

C. Cavity Vents:
1. Type: Polyester mesh.
2. Color(s): As indicated on drawings.

D. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1. Mortar Diverter: Panels installed at flashing locations.
a. Manufacturers:
1) Mortar Trap by Hohmann & Barnard.
2) Mortar Net by Mortar Net.

E. Precast Concrete Amortizement:
1. Flashing:
a. Description:
1) Prevent entry of water into masonry cavity under precast concrete amortizement.
b. Design Criteria:
1) 26 ga (0.019) (0.4826 mm) stainless steel AISI Type 304 drip edge/plate flashing with drip edge hemmed back.
2) Apply sealant and backing rod.
c. Acceptable Products:
1) No. 1007 Hemmed Drip-Edge Flashing by Heckmann.

2) Drip Plate by Hohmann & Barnard.
3) Sandell's Drip Edge by Sandell Construction Solutions.
4) No. 4156 Drip Edge Flashing by Wire-Bond.
5) Equal meeting Design Criteria as approved by Architect.

2. Cast in Place Anchor Strap:
   a. Design Criteria:
      1) Provide three (3) straps, one (1) at each end and at midpoint with four (4) #8 noncorrosive screws per strap as shown on Contract Drawings.
   b. Acceptable Products:
      1) Simpson LSTA18.
      2) Equal meeting Design Criteria as approved by Architect.

F. Cleaning Compounds:
   1. Use type of compound recommended by Brick Manufacturer based on minerals present in masonry units.
   2. Acceptable Products:
      a. 202 or 202V by Diedrich Technologies, Oak Creek, WI www.diedrichtechnologies.com.
      b. Surekleen No. 600 or Vana-Trol by ProSoCo Inc, Kansas City, KS www.prosoco.com.

G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## 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.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Coordinate placement of reinforcement, anchors, ties and accessories, flashings and weep holes and weep vents, and other moisture control products.

### 3.02 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. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

### 3.03 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
   1. Except at foundations, which may vary in thickness, joints are to be 3/8 inch thick.

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 as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

### 3.04 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and at top of walls.

### 3.05 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

### 3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 1.77 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

G. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

### 3.07 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 at least 1 inch, minimum, to form watertight pan at non-masonry 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. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
   2. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.
   3. Terminate vertical leg of flashing into bed joint in masonry or reglet in concrete.
   4. Anchor vertical leg of flashing into backing with a termination bar and sealant.
   5. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

D. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

E. Support flexible flashings across gaps and openings.

F. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

### 3.08 LINTELS

A. Install loose steel lintels over openings.

B. Maintain minimum [__6__] inch bearing on each side of opening.

### 3.09 VENTS (OPEN HEAD JOINTS)

A. Place vents at top of cavity air space of full height masonry walls.

B. Install weep vents in weep holes at 33 inches on center maximum and should be centered between weep holes at base of masonry walls.

### 3.10 MORTAR GUARD

A. Place mortar guard continuously between brick and sheathing at bottom masonry course at foundation and above windows, and doors.

### 3.11 EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Size expansion joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

C. Form expansion joint as detailed on drawings.

### 3.12 FIELD QUALITY CONTROL

A. Field Tests and Inspections (Required Level 1 masonry inspection for non-essential facilities):
   1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in01 4000 - Quality Requirements :
      a. Quality Control is sole responsibility of Contractor.
         1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
            (a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
   2. Masonry (Masonry Prisms, Masonry Units, Reinforcement, Mortar and Grout):
      a. Testing and Inspections shall conform to IBC Section 17 'Special Inspections and Tests' and in accordance with Chapter 3 'Quality And Construction' of TMS 402/ACI 530.1/ASCE 5 (Building Code Requirements for Masonry Structures) and TMS 602/ACI 530.1/ASCE 6 (Specification for Masonry Structures):
         1) Quality assurance program shall comply with requirements of Chapter 3, for Level A 'Quality Assurance' for Risk Category I, II, or III structures or Level B 'Quality Assurance' for Risk Category IV structures and as defined in ASCE 7 or latest approved adopted building code. See Structural Design Criteria as shown on Contract Documents.

B. Non-Conforming Work:
   1. Remove and replace defective material at Architect's direction and at no additional cost to Owner.

### 3.13 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maintain 3/8 inch mortar joints throughout.

### 3.14 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. 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.

### 3.15 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

### 3.16 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

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**SECTION 05 1200**
**STRUCTURAL STEEL FRAMING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Structural steel framing members.

### 1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting

### 1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).

B. AISC (MAN) - Steel Construction Manual 2017.

C. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

D. AISC 360 - Specification for Structural Steel Buildings 2016 (Revised 2021).

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

J. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.

K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2022.

L. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2020.

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

O. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018.

P. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars 2018, with Amendment (2020).

Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

R. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2020.

S. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

T. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

U. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

V. SSPC-SP 2 - Hand Tool Cleaning 2018.

W. SSPC-SP 3 - Power Tool Cleaning 2018.

X. SSPC-SP 6 - Commercial Blast Cleaning 2007.

### 1.04 SUBMITTALS

A. Action Submittals:

1. Product Data:
    a. Product data and samples, if requested by Architect.

B. Shop Drawings:
1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Connections not detailed.
3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Informational Submittals:
1. Certificates:
    a. Certificate of conformance by Manufacturer certifying that steel is new steel conforming to referenced ASTM requirements and standards.
    b. Fabricator certificates.
    c. Mill certificates certifying chemical and physical properties of all steel furnished on Project.
    d. Welding certificates

D. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    a. Record Documentation:
        1) Testing and Inspection Reports:
            (a) Testing Agency Inspection Reports of structural steel framing.

**1.05 QUALITY ASSURANCE**

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Pre-Installation Conference:
1. Participate in pre-installation conference.
2. In addition to agenda items specified in Section 01 3000, review following:
    a. Review Section 01 4000 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
        1) Review requirements and frequency of testing and inspections.
    b. Meet with Architect before commencing repair of galvanized surfaces to establish extent of repairs required and, if applicable, choice of methods to be used.

C. Scheduling:
1. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing structural steel framing.
2. Notify Testing Laboratory at least three (3) weeks in advance of fabrication

D. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

E. Testing And Inspection.
1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
2. Owner will provide Testing and Inspection for inspection of structural steel framing:
    a. Owner will employ testing agencies to perform inspection of structural steel framing as specified in Field Quality Control in Part 3 of this specification:
        1) Owner’s employment of an independent Testing Agency does not relieve Contractor of Contractor’s obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.

**PART 2 PRODUCTS**

## 2.01 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

E. Pipe: ASTM A53/A53M, Grade B, Finish black.

F. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
   3. Height Change, Plastic State; when tested according to ASTM C827/C827M:
      a. Maximum: Plus 4 percent.
      b. Minimum: Plus 1 percent.

I. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

K. Steeple Base Support:
   1. Finish:
      a. Corlar 2.1-ST satin high solids epoxy mastic by Dupont Industrial Coatings:
         1) Thickness: Apply 10 mils thick.
      b. Manufacturers:
         1) Dupont Industrial Coatings, Wilmington, DE www.dupont.com.
         2) Equal as approved by Architect befor bidding.

## 2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Requirements: Structural metal shall be product of domestic mill.
   1. ANSI/AISC 360 shall serve as minimum standard.
   2. Fabricate items to be embedded in concrete or masonry according to approved details of work to be connected.

## 2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

## 3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components and shear studs indicated on shop drawings.

D. Minimum weld sizes, unless detailed otherwise.
   1. Weld pipe columns to base plates and top plates with 1/4 inch fillet weld all around.
   2. Weld glu-lam connection side plates to base plates with 1/4 inch fillet weld all along outside edges.
   3. Weld stiffeners to pipe columns with 1/4 inch fillet weld all around.

E. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

F. Do not field cut or alter structural members without approval of Architect.

G. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

H. Do not overload or exceed carrying capacity of any structural steel element during construction period.

I. Bridging installation shall proceed concurrently with truss erection and be completed before trusses are subjected to construction loads.
   1. Do not remove bridging after construction is complete.

J. Plates or Channels Embedded in Concrete:
   1. Tack weld bolts to plates or channels to prevent bolts from turning when nuts are tightened.

K. Immediately after erection, clean completed field connections and damaged surfaces with solvents and hand or power tools. After cleaning, apply corrosion-resistant primer compatible with factory-applied primer.

L. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

M. Interface With Other Work:
   1. Furnish items to be embedded in concrete or masonry to Division 03 or 04 respectively in time to be securely tied in place before placing concrete and grout.

## 3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

## 3.04 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner’s independent Testing Agency as specified in Section 01 4523 ‘Testing and Inspection Services’:
      a. Quality Control is sole responsibility of Contractor.
         1) Owner’s employment of an independent Testing Agency does not relieve Contractor of Contractor’s obligation to perform testing and inspection as part of his Quality Control:
            (a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
   2. General Requirements:
      a. Furnish items to be embedded in concrete or masonry to Division 03 or 04 respectively in time to be securely tied in place before placing concrete and grout.
   3. Structural Steel - General:
      a. Testing Agency shall provide testing and inspection of structural steel including following:

1) Mill Certificates:
   (a) Mill certificates or affidavits and manufacturer's certification shall be supplied to inspector for verification of steel materials.
   (b) Testing laboratory shall be notified at least three (3) weeks in advance of fabrication and supplied with reports so that shop inspection may be performed.
2) General Inspection:
   (a) Testing Agency shall be at fabricator's plant to verify that materials used match mill tests or affidavits of test reports; that fabrication, welding procedures, surface preparation, and shop painting meet specifications; and that work in progress conforms to project requirements.
   (b) Testing Agency shall visually check fabricated steel delivered to job to confirm that work is in compliance with approved shop drawings and shall make any physical tests, measurements, etc., believed to be necessary.
   (c) Testing Agency shall witness and report all corrections performed by steel fabricator occurring on fabricators own initiative.
3) Bolting Requirements: All inspection shall conform to requirements of current edition of AISC 340, 'Specification for Structural Joints using High-Strength Bolts' using ASTM F3125/F3125M Grade A325 and Grade A490 Bolts:
   (a) Miscellaneous Metal: Where miscellaneous angles, channels, studs, and similar shapes are detailed for support of major components of work, welds, bolts, and material are subject to same testing requirement as other structural supporting members.
   (b) Inspections shall include required verification and inspection of steel construction as referenced in IBC Section 17 'Special Inspections And Tests' and in accordance with ANSI/AISC 360 and applicable ASTM material standards, and ANSI/AISC 360, Section M2.5. Periodic and continuous inspections include:
   (c) Material verification of high-strength bolts, nuts and washers:
   (d) Identification markings to conform to AWS designation listed in WPS (periodic).
   (e) Manufacturer's certificated of compliance required (periodic).
   (f) Inspection of high-strength bolting:
   (g) Snug-tight joints.
   (h) Pretensioned and slip-criteria joints using turn-of-nut with match marking, twist-off bolt or direst tension indicator methods of installation (periodic).
   (i) Pretension and slip-critical joints using turn-of-nut without match marking or calibrated wrench methods of installation (continuous).
4) Welding Requirements: Inspection shall be provided by Testing Agency for all welding in accordance with Building Code:
   (a) Nondestructive testing shall be performed as required by Building Code and ANSI/AWS D1.1/D1.1M as specified herein for all shop and field welds.
   (b) Ultrasonically test 100 percent of all complete penetration welds and 100 percent of all partial-penetration column splice welds.
   (c) Ultrasonically test all joints where base metal is thicker than 1-1/2 inches (38 mm), when subjected to through-thickness weld shrinkage strains. Joint shall be ultrasonically inspected for discontinuities directly behind such welds after joint completion.
   (d) When ultrasonic indications arising from weld root cannot be interpreted as either weld defect or backing strip itself, backing strip shall be removed at expense of Contractor, and if no root defect is visible, weld shall be re-tested. If no defect is indicated on this re-test, and no significant amount of weld metal has been removed, no further repair of welding is necessary. If defect is indicated, it shall be repaired at no expense to Owner.

(e) Perform Magnetic Particle (MP) tests of fillet welds larger than 5/16 inch (8 mm).
(f) Exceptions:
(1) When approved by Owner's Representative and/or Architect/Engineer, rate of testing for ultrasonic testing of complete-penetration welds may be reduced in accordance with following:
(2) Nondestructive testing rate for individual welder or welding operator may be reduced to 25 percent, provided reject rate is demonstrated to be 5 percent or less of welds tested for welder or welding operator. Sampling of at least 40 completed welds for job shall be made for such reduction evaluation. Reject rate is defined as number of welds containing rejectable defects divided by number of welds completed).
(3) For complete penetration groove welds on materials less than 5/16 inch (8 mm) thick, nondestructive testing is not required provided continuous inspection is provided.
(4) When approved by building official, nondestructive ultrasonic testing may be performed in shop of AISC approved fabricator utilizing qualified test techniques in employment of fabricator.
(5) Other ultrasonic or magnetic particle testing may be reduced by approval of Owner's Representative and/or Architect/Engineer upon presentation of satisfactory documentation submitted by Contractor.
(6) There shall be no exceptions to testing requirements for SFRS.
(g) Inspections shall include required verification and inspection of steel construction as referenced in IBC Section 17 'Special Inspections and Tests' and in accordance with ANSI/AISC 360, Section A3.5 and applicable ANSI/AWS A5 documents, ANSI/AWS D1.1/D1.1M, ANSI/AWS D1.3/D1.3M, ANSI/AWS D1.4/D1.4M, and ACI 318 or ACI 318M, Section 3.5.2. Periodic and continuous inspections include:
(1) Material verification of weld filler materials:
(2) Identification markings to conform to AWS designation listed in WPS (periodic).
(3) Manufacturer's certificated of compliance required (periodic).
(4) Inspection of welding:
(5) Structural steel and cold-formed steel deck:
(6) Complete and partial joint penetration groove welds (continuous).
(7) Multipass fillet welds (continuous).
(8) Single-pass fillet welds > 5/16 inch (8 mm) (continuous).
(9) Plug and slot welds (continuous).
(10) Single-pass fillet welds less than or equal to 5/16 inch (8 mm) (periodic).

5) Steel Frame Requirements:
(a) Inspections shall include required verification and inspection of steel frame as referenced in IBC Section 17 'Special Inspections And Tests' and in accordance with ANSI/AISC 360 and Applicable ASTM material standards. Periodic inspections include:
(b) Inspection of steel frame joint details compliance with approved construction documents:
(c) Details such as bracing and stiffening (periodic).
(d) Member locations (periodic).
(e) Applications of joint details at each connection (periodic).

**END OF SECTION**

**SECTION 05 5000**
**METAL FABRICATIONS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Prefabricated ladders.

C. Ship ladders.

D. Cart bumper rails.

E. Counter and bench brackets.

F. Bollards.

G. Miscellaneous steel.
   1. Channel frames for doors.
   2. Lintels.
   3. Platform door frames.
   4. Rostrum riser handrail.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.

D. Section 05 5100 - Metal Stairs.

E. Section 05 5213 - Pipe and Tube Railings.

### 1.03 REFERENCE STANDARDS

A. ALI A14.3 - Ladders - Fixed - Safety Requirements 2008.

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

I. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.

J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

K. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

M. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

### 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including 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.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
      a. Include the following, as applicable:
         1) Design criteria.
         2) Engineering analysis depicting stresses and deflections.
         3) Member sizes and gauges.
         4) Details of connections.
         5) Support reactions.
         6) Bracing requirements.

### 1.05 QUALITY ASSURANCE

A. Welders shall be certified 30 days minimum before beginning work on project. If there is doubt as to proficiency of welder, Architect may require welder to take another test, at no expense to Owner. Certification shall be by Pittsburgh Laboratories or other authority approved by Architect.

B. Maintain welders' certifications on job-site.

## PART 2 PRODUCTS

### 2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Rostrum Riser Handrail Pipe Sleeves And Base Plates:
   1. 2 inch diameter pipe sleeve welded to base plates. Allow 1/2 inch minimum of grout around perimeter of pipe. Field verify sleeve length.
   2. Cap bottom of sleeve forming closure as shown on Contract Drawings.
   3. 8 inch x 16 inches x 1/4 inch steel base plate (post installed anchor bolts per Section 03 3000 Cast in Place Concrete).

F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
   1. Anchor Rods For Steeple Base Connections: Conform to requirements of ASTM A36/A36M.

2. Anchor bolts: Conform to requirements of ASTM A307, Grade A.

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. Continuously seal joined members by intermittent welds and plastic filler.

D. 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.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. After fabrication, and before shop priming, hot-dip or mechanically galvanize to be installed in following:
   1. Bollards
   2. Channel frames
   3. Lintels in exterior walls

G. Powder Coated:
   1. Rostrum Riser Handrail Pipe Sleeves And Base Plates:
      a. Powder coated after complete fabrication:
         1) Preparation:
            (a) Meet ASTM standards for powder coating.
            (b) Steel must be free of any scale, paint, varnish, grease or rust.
            (c) Chemical wash and rinse.
            (d) Apply corrosion-inhibiting iron phosphate treatment
         2) Apply powder coating
      b. Color: As selected by Owner from Manufacturer's standard colors.

H. 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. Vertical Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish (stainless steel for exterior ladders, Type 304, Schedule B).
   1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
   2. Rungs: one inch diameter solid round bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.
   4. Requirements for cages, wells, and ladder safety systems used with fixed ladders, in order to minimize personal injuries.
   5. All parts and appurtenances necessary for safe and efficient ladder shall be considered integral parts of design.
   6. Weld joints. Grind joints to be smooth to the touch and finished to match adjoining surfaces.

7. Space treads 12 inches on centers.
8. Fabricate mounting brackets of drilled angles.
9. Prime interior ladders.
10. Accessories:
11. Safety Post for Welfare Services Projects:
    a. Enables user to step on or off fixed ladder below in safe standing position while holding onto post.
    b. Telescoping, steel, spring balanced, painted finish.
    c. Extends to 42 inches (1 067 mm) to locked position.
12. Design Criteria:
    a. Meets ANSI A14.3 and OSHA 1910.27 requirements 200 pound load.
13. Acceptable Products: Model SLP by Maxam Metal Products Limited, Burnaby, BC www.maxammetal.com.

B. Ship Ladders: Stringers, Railings, And Anchorage: Structural steel plates, shapes, and bars meeting or exceeding requirements of ASTM A36/A36M.
    1. Treads: 4 inches wide except use 5 inches wide for Welfare Services Projects.
    2. Acceptable Products:
        a. Type 106A by Wooster Products Inc, Wooster, OH www.wooster-products.com.
        b. Equal as approved by Architect before use. See Section 01 6200.
    3. Fabrication:
        a. Shop Assembly:
            1) Preassemble items in shop to greatest extent possible to minimize field splicing and assembly:
                (a) Disassemble units only as required for shipping and handling.
                (b) Clearly mark units for reassembly and coordinated installation.
            2) Fabricate ladders to comply with requirements of ANSI/ALI A14.3 including but not limited to:
                (a) Minimum requirements for design, construction, and use of fixed ladders.
                (b) Requirements for cages, wells, and ladder safety systems used with fixed ladders, in order to minimize personal injuries.
                (c) All parts and appurtenances necessary for safe and efficient ladder shall be considered integral parts of design.
            3) Grind smooth exposed welds to be smooth and invisible to sight when primed.
            4) Finishes: Shop prime after fabrication.
    4. Accessories:
        a. Platform: Metal deck shall be diamond plate.
        b. Railing to Mezzanine.

C. Counter and Bench Brackets:
    1. Materials: Steel: Meet requirements of ASTM A36/A36M.
    2. Fabrication:
        a. Fabricate as detailed.
        b. Grind exposed welds smooth and polish to match non-welded metal finish.
        c. After fabrication and drilling of mounting holes, shop prime.

D. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.
    1. After fabrication and galvanizing shop prime.

2. Bollards: 6 inch (150 mm) minimum diameter, unless noted otherwise on Contract Drawings, meeting requirements of ASTM A53/A53M, Type E or S, Grade B, Weight Class, STD, Schedule 40.
    a. Sleeves, if required by Contract Drawings:
        1) Polyethylene thermoplastic. Custom Color G198456-M Bright Purple.
        2) Acceptable Product:
            (a) BPD-YL-42-P by IdealShield, Detroit, MI www.idealshield.com.

**2.04 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.

B. Before fabrication of ships ladder, verify by field measurements that ships ladder will fit in space where it is to be installed.

C. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

**3.02 PREPARATION**

A. Clean and strip primed steel items to bare metal where site welding is required.

B. 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 ladder safety system in accordance with manufacturer's instructions.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Minimum weld sizes, unless detailed otherwise:
    1. Weld pipe columns to base plates and top plates with 1/4 inch fillet weld all around.
    2. Weld glu-lam connection side plates to base plates with 1/4 inch fillet weld all along outside edges.
    3. Weld stiffeners to pipe columns with 1/4 inch fillet weld all around.

F. Obtain approval prior to site cutting or making adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

**3.04 LADDER INSTALLATION**

A. Support ladder with welded steel brackets located at top and bottom, and equally spaced but no more than 60 inches on center between top and bottom where ladder is installed against a wall. Size brackets to support design loads specified in ANSI/ALI A14.3.

B. Safety Post at Vertical Ladders:
   1. Mount safety post to top two rungs of fixed vertical ladder.

**3.05 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.

**3.06 ADJUSTING**

A. Immediately after installation, touch up primed surfaces damaged by installation procedures to provide appropriate surface for finish painting.

**END OF SECTION**

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**SECTION 05 5213**
**PIPE AND TUBE RAILINGS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Free-standing railings at steps.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.

B. Section 04 2000 - Unit Masonry: Placement of anchors in masonry.

C. Section 09 9113 - Exterior Painting: Paint finish.

D. Section 09 9123 - Interior Painting: Paint finish.

### 1.03 DEFINITIONS

A. Galvanized: To coat iron or steel with zinc for protection from rust and corrosion.

B. Non-shrink Grout: Structural grout used for filling voids between elements that is formulated with cement, fine aggregates and admixtures. Admixtures are used to provide expansive properties of the material during curing. This expansion counteracts the natural tendency of cement grouts to shrink during curing.

C. Peened: Nonslip textured gripping surface that is much easier to hold on to.

D. Stainless Steel Alloys:
   1. Type 304 (UNS S30400): Austenitic stainless steel with non-magnetic properties in annealed condition that provide good corrosion resistance to both chemical and atmospheric exposures, with high resistance to oxidations. Most common and widely used stainless steel.

### 1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures 2006.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

F. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.

G. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.

H. ASTM E2072 - Standard Specification for Photoluminescent (Phosphorescent) Safety Markings 2014.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

J. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

## 1.05 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

B. Designer's Qualification Statement.

## 1.06 DELIVERY, STORAGE AND HANDING

A. Storage and Handling Requirements:
   1. Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, and protected against damage.
   2. Cover with waterproof paper, tarpaulin, or polyethylene sheeting. Allow for air circulation inside covering.

## 1.07 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

# 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 75 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. 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. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

F. 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.

G. Provide slip-on non-weld mechanical 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.

## 2.02 STEEL RAILING SYSTEM

A. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.

B. 1-1/2 inch outside diameter.

C. Pipe Sleeves:
   1. 2 inch diameter by 6 to 9 inches long non-magnetic stainless steel with cross-section shape and dimension to allow 1/2 inch minimum of grout around perimeter of pipe or tube.
   2. Provide with fully welded steel plate forming bottom closure.

D. Brackets, Flanges, Fittings, And Anchors:
   1. Provide standard wall brackets, flanges, miscellaneous fittings, and anchors for connection of handrails and railings to other construction.
   2. Provide inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work.

E. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

F. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

G. Exposed Fasteners: No exposed bolts or screws.

H. Galvanizing: In accordance with requirements of ASTM A123/A123M.
   1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.

I. Return pipe ends of wall mounted handrails into wall.

J. Cap pipe ends of floor / ground mounted handrails and exterior handrails.

K. After fabrication, shop prime metal to be painted.

L. Bicycle Rack Posts, Stair Posts and Base Plates:
   1. Embedded posts and base plates to be of stainless steel per Contract Drawings.

## 2.03 STAINLESS STEEL RAILING SYSTEM

A. Handrails to Font, Handrails to Rostrum, Handrails to Platform:
   1. Material: 1-1/2 inch outside diameter non-magnetic satin finish 16 gauge type 304 stainless tubing.
   2. Sizes and configurations as indicated on Contract Drawings.
   3. Handrails to Font:
      a. Provide peened nonslip textured gripping surface.
      b. Brackets, Flanges, Fittings, And Anchors:
         1) Provide standard wall brackets, flanges, miscellaneous fittings, and anchors for connection of handrails and railings to other construction.
         2) Provide inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work.
   4. Handrails to Platform:
      a. Brackets, Flanges, Fittings, And Anchors:
         1) Provide standard wall brackets, flanges, miscellaneous fittings, and anchors for connection of handrails and railings to other construction.
         2) Provide inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work.
   5. Rostrum Riser Handrail (floor mounted):
      a. Stainless steel bar.
      b. Stainless steel mounting plate for hardwood handrail.
      c. Sizes and configurations as indicated on Contract Drawings.

## 2.04 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 intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. 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.

E. Font Handrail: Provide peened nonslip textured gripping surface.

### 2.05 ACCESSORIES

A. Rail Setting Grout:
   1. Commercial nonshrink grout conforming to requirements of ASTM C1107/C1107M, Type B or Type C.

## 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 ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Coring of concrete for installation of balusters is acceptable.

F. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

G. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

H. Touch up field welds to match pre-finished material.

### 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 06 1000**
**ROUGH CARPENTRY**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Nonstructural dimension lumber framing.

C. Rough opening framing for doors, windows, and roof openings.

D. Sheathing.

E. Roof-mounted curbs.

F. Roofing nailers.

G. Preservative treated wood materials.

H. Miscellaneous framing and sheathing.

I. Communications and electrical room mounting boards.

J. Concealed wood blocking, nailers, and supports.

K. Miscellaneous wood nailers, furring, and grounds.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.

B. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

C. Section 06 1733 - Wood I-Joists.

D. Section 06 1753 - Shop-Fabricated Wood Trusses.

E. Section 06 1800 - Glued-Laminated Construction.

F. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

G. Section 31 3116 - Termite Control: Field-applied termiticide and mildewcide for wood materials.

### 1.03 REFERENCE STANDARDS

A. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions 2012a (Reapproved 2018).

B. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples 2021.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

E. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).

F. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing 2019a.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.

H. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers 2016, with Editorial Revision (2019).

I. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems 2014, with Editorial Revision (2017).

J. PS 1 - Structural Plywood 2009 (Revised 2019).

K. PS 2 - Performance Standard for Wood Structural Panels 2018.

L. PS 20 - American Softwood Lumber Standard 2021.

M. SPIB (GR) - Grading Rules 2014.

N. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2018.

O. WWPA G-5 - Western Lumber Grading Rules 2021.

**1.04 SUBMITTALS**

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Manufacturer's literature on framing anchors and powder-actuated fasteners.
   1. Submit diameter and lengths of fasteners proposed for use on Project. If length of diameter of proposed fasteners differ from specified fasteners, also include technical and engineering data for proposed fasteners including, but not limited to:
      a. Adjusted fastener spacing where using proposed fasteners and,
      b. Adjusted number of fasteners necessary to provide connection capacity equivalent to specified fasteners.
   2. Submit on powder-actuated fasteners other than those specified in Contract Documents, show design criteria equivalents at each location.
   3. Show type, quantity and installation location of framing anchors. Where necessary, reference Drawing details, etc, for installation locations.

D. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

**1.05 DELIVERY, STORAGE, AND HANDLING**

A. Delivery And Acceptance Requirements:
   1. Protect lumber and sheathing and keep under cover in transit and at job site.
   2. Do not deliver material unduly long before it is required.

B. Storage And Handling Requirements:
   1. Store lumber and sheathing on level racks and keep free of ground to avoid warping.
   2. Stack to insure proper ventilation and drainage.

**1.06 QUALITY ASSURANCE**

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference.
      a. Schedule pre-installation conference immediately before beginning framing work.
      b. In addition to agenda items specified in Section 01 3100, review following:
         1) Equipment and gypsum board blocking in wood framed walls.
         2) Operable partition headers.
         3) Rough opening.
         4) Shear walls and struts.
         5) Nails and nailing requirements.
         6) Truss installation.
         7) Connections.
   2. Participate in pre-installation conference held jointly with Section 08 4113.
      a. Schedule pre-installation conference for one (1) week before scheduled installation of storefront system.
      b. In addition to agenda items specified in Section 01 3100, review following:

1) Rough opening requirements.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A. Suppliers:
   1. Builders First Choice, West Jordan, UT. www.BLDR.com. Contact Dan Egelund.
      a. Office: (801) 224-0541.
      b. Mobile: (801) 376-2385.
      c. E-Mail: Dan.Egelund@bldr.com
   2. J. M. Thomas Forest Products, Ogden, UT. www.thomasforest.com. Contact Tom Karren:
      a. Office: (800) 962-8780.
      b. FAX: 801-782-9652.
      c. E-Mail: tom@thomasforest.com.
   3. Shelter Products, Inc., Portland, OR www.shelter-products.com. Contact Grant Buchanan or Andy Beltz:
      a. Office: (800) 662-3612.
      b. Cell: NA.
      c. FAX: (503) 238-2663.
      d. E-Mail: gbuchanan@shelter-products.com.
      e. E-mail: abeltz@shelter-products.com.

B. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   4. Design Criteria:
      a. Meet requirements of PS 20 and National Grading Rules for softwood dimension lumber.
      b. Bear grade stamp of WWPA, SPIB, or other association recognized by American Lumber Standards Committee identifying species of lumber by grade mark or by Certificate of Inspection.
      c. Lumber 2 inches (50 mm) or less in nominal thickness shall not exceed 19 percent in moisture content at time of fabrication and installation and be stamped 'S-DRY', 'K-D', or 'MC15'.
      d. Preservative Treated Plates / Sills:
         1) 2x4 (38 mm by 64 mm): Standard and better Douglas Fir, Southern Pine, or HemFir, or StrandGuard by iLevel by Weyerhaeuser Boise, ID www.ilevel.com. (LSL 1.3 E) or as indicated on Contract Drawings.
         2) 2x6 (38 mm by 140 mm) And Wider: No. 2 or MSR 1650f - 1.5e Douglas Fir, Southern Pine, HemFir, or StrandGuard by iLevel by Weyerhaeuser, Boise, ID www.ilevel.com. (LSL 1.3 E) or as indicated on Contract Drawings.
   5. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

C. Posts, Beams, And Timbers 5 Inches by 5 Inches (125 mm by 125 mm) And Larger:
   1. Design Criteria:
      a. No. 1 or better Douglas Fir or Southern Pine unless noted otherwise by Contract Drawings.

D. Lumber Ledgers:
   1. Design Criteria:

a. No. 1 Douglas Fir-Larch, or Southern Pine unless noted otherwise by Contract Drawings.

## 2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing:
   1. Species: Any allowed under referenced grading rules, or as noted by contract drawings.
   2. Grade: No. 2, or as noted by Contract Drawings.

D. Joist, Rafter, and Small Beam Framing:
   1. Machine stress-rated (MSR) as follows:
      a. Fb-single (minimum extreme fiber stress in bending): 1350 psi, or as noted by Contract Drawings.
      b. E (minimum modulus of elasticity): 1,300,000 psi, or as noted by contract drawings.
   2. Species and Grades: As indicated on drawings for various locations.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

## 2.03 STRUCTURAL COMPOSITE LUMBER

A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

B. Materials shall be tested and evaluated in accordance with ASTM D5456.

C. Materials shall have current ICC-ES Evaluation Report, report approved by International Codes Council, or report issued by Architect approved model code evaluation service and shall comply with requirements of report.

D. Identify materials by stamp or stamps indicating manufacturer's name, product trade name, grade, species (if applicable), evaluation report number, plant number, and name or logo of independent inspection agency.

E. Adhesive: Meet requirements of ASTM D2559.

F. Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
   1. Columns: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published modulus of elasticity, E: 1,800,000 psi, minimum.
   2. Beams: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published modulus of elasticity, E: 1,800,000 psi, minimum.
   3. Headers Not Longer Than 48 inches: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber.
   4. Products:
      a. Boise Cascade Company: www.bc.com/#sle.
      b. Weyerhaeuser Company: www.weyerhaeuser.com/#sle.
      c. Jager Industries Inc, Calgary, AB www.jagerbuildingsystems.com 4. Louisiana Pacific Corp, Portland, OR www.lpcorp.com.
      d. Roseburg Forest Products, Roseburg, OR www.roseburg.com.
      e. Trus Joist Corp, Div Weyerhaeuser, Boise, ID www.tjm.com or Surrey, BC (604) 588-7878.
      f. Web Joist, Chehalis, WA www.webjoist.com.

## 2.04 CONSTRUCTION PANELS (WOOD SHEATHING)

A. See Contract Drawings for required thicknesses, span ratings and attachment requirements.

B. Sheathing: Meet requirements of PS 1, PS 2, or PRP-133 (TECO). Except where plywood is specifically indicated on Contract Drawings, oriented strand board (OSB) is acceptable.

C. Sheathing shall bear grade stamp from American Plywood Association (APA) or equal grading organization.

D. Sheathing shall not exceed 18 percent moisture content when fabricated or more than 19 percent when installed in Project.

E. Sheathing used for same purpose shall be of same thickness. In all cases, thickness specified is minimum required regardless of span rating.

F. Minimum span ratings for given thicknesses shall be as follows:
   1. Thickness = Span Rating
      a. 3/8 inch = 24 / 0
      b. 7/16 inch nominal = 24 / 16
      c. 15/32 inch actual = 32 / 16
      d. 1/2 inch nominal = 32 / 16
      e. 19/32 inch actual = 40 / 20
      f. 5/8 inch nominal = 40 / 20
      g. 23/32 inch actual = 48 / 24

**2.05 ACCESSORIES**

A. Fasteners and Anchors:
   1. General:
      a. Fasteners for preservative treated and fire-retardant-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronzed, or copper. Coating weights for zinc-coated fasteners shall be in accordance with ASTM A153/A153M.
   2. Blocking:
      a. Sound lumber without splits, warps, wane, loose knots, or knots larger than 1/2 inch.
      b. Utility or better
   3. Nails:
      a. Meet requirements of ASTM F1667.
      b. Unless noted otherwise, nails listed on Drawings or in Specifications shall be common nail diameter, except 16d nails, which shall be box diameter.
   4. SDS Screws:
      a. Category Four Approved Products. See Section 01 6200 for definitions of categories.
      b. SDS Screws by Simpson Strong Tie Co, Dublin, CA www.strongtie.com.
   5. Powder-Actuated Fasteners:
      a. Type One Quality Standard: Hilti X-DNI 62P8.
      b. Manufacturers:
         1) Hilti, Tulsa, OK www.us.hilti.com.
         2) Redhead Division of ITW, Wood Dale, IL www.itw-redhead.com and Markham, ON www.itwconstruction.ca.
   6. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   7. Framing Anchors:
      a. Framing anchors and associated fasteners in contact with preservative hot dipped zinc coated galvanized steel or stainless steel. Do not use stainless steel items with galvanized items.
      b. Acceptable Products:
         1) KC Metals Inc, San Jose, CA www.kcmetals.com.
         2) Simpson Strong Tie Co, Dublin, CA www.strongtie.com.
         3) United Steel Products Co Inc (USP), Montgomery, MN www.uspconnectors.com.
         4) Equals as approved by Architect through shop drawing submittal before installation.

B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

C. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

D. Termite-Resistant Sill Plate Barrier: Self-adhesive, film-backed barrier with release sheet; adheres to concrete substrates and blocks termite access.
   1. Thickness: 68 mil, 0.068 inch.
   2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

E. Subfloor Adhesives: Gap-filling construction adhesive for bonding wood structural panels to wood-based floor system framing; complying with ASTM D3498.

F. Construction Adhesives: Adhesives complying with ASTM C557 or ASTM D3498.
   1. Manufacturers:
      a. Meet requirements of 'APA-The Engineered Wood Association' Specification AFG-01 or ASTM D3498.
      b. Use phenol-resorcinol type for use on pressure treated wood products.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Use preservative treated wood for wood members in contact with concrete or masonry, including wall, sill and ledger plates, door and window subframes and bucks, etc.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

### 3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

### 3.03 FRAMING INSTALLATION

A. Basketball Standards:
   1. See Basketball Equipment Specification for installation instructions and template.
      a. Use Basketball Manufacturer's template for location of basketball hanger brackets.
      b. Verify field dimension of brackets.

B. Furring Strips:
   1. On Wood or Steel: Nail or screw as required to secure firmly.
   2. At ceilings:
      a. Attach furring strips to the underside of structural elements with #8 wood screws, of length to penetrate wood framing 1 inch minimum.

C. Floor Framing:
   1. Place with crown side up.
   2. Install structural blocking and bridging as necessary and as described in Contract Drawings.
   3. Provide accurately fitted header and trimmer joist of same size as regular joists around floor openings, unless detailed otherwise and support by steel joist hangers.
   4. Double joists under partitions that parallel run of joists.

D. Roof and Ceiling Framing:
   1. Place with crown side up.

2. Install structural blocking and bridging as necessary and as described in Contract Drawings.
3. Special Requirements:
    a. Roof and Ceiling Joists: Lap joints 4 inches minimum and secure with code approved framing anchors.
    b. Roof Rafters and Outlookers:
        1) Cut level at wall plate and provide at least 2-1/2 inches bearing where applicable. Spike securely to plate with three 10d nails.
        2) Attach to trusses or other end supports with framing anchors described in Contract Drawings.
        3) Provide for bracing at bearing partitions.

E. Installation of Wood Trusses:
1. Handle, erect, and brace wood trusses in accordance with TPI/WTCA Booklet BCSI.
2. Do not install damaged or broken wood trusses. Replace wood trusses that are broken, damaged, or have had members cut out during course of construction.
3. Provide construction bracing from trusses in accordance with TPI DSB-89.
4. Provide continuous 2x4 horizontal web bracing as shown on truss shop drawings.
    a. Secure bracing to each truss with two 10d or 16d nails.
    b. Lap splice bracing by placing bracing members side by side on common web member. Butt splices are not acceptable.
5. Unless directed or shown otherwise, provide diagonal 2x4 bracing between trusses at each line of horizontal web bracing.
    a. This diagonal bracing shall be continuous and extend from junction of web and top chord of one truss to junction of web and bottom chord of different truss.
    b. Install bracing at approximately 45 degree angle. Bracing will extend over three trusses minimum or more as determined by height of trusses and 45 degree installation angle.
    c. Install brace on side of web opposite horizontal web bracing and nail to each web with two 10d or 16d nails.
    d. Install one brace every 20 feet as measured from top of brace to top of next brace.

F. Wall Framing:
1. Openings: Single, bearing stud supporting header and on adjacent (king) stud continuous between top and bottom plates, unless show otherwise.
2. Corners And Partition Intersections: Triple Studs.
3. Top Plates in Bearing Partitions/Walls: Doubled or tripled and lapped, unless shown otherwise. Stagger joints at least 48 inches.

G. Installation of GlueLams:
1. Install work in accordance with Fabricator's instructions and GlueLam Erection Safety Practices.
2. Adequately support and brace work until tied into building structure to insure against collapse due to wind or other forces.
3. Maintain protection of beams until roofing has been installed.

H. Installation of Structural Composite Lumber:
1. Install temporary horizontal and cross bracing to hold members plumb and in safe condition until permanent bracing is installed.
2. Install permanent bracing and related components before application of loads to members.

I. Installation of Wood Web Joists (I-Joists):
1. Handle, erect, and brace sheathing wood web joists in accordance with Manufacturer's instructions.
2. Do not install damaged or broken wood web joists.

3. Install temporary horizontal and cross bracing to hold members plumb and in safe condition until permanent bracing is installed.
4. Cut holes through webs at locations or of sizes shown on Drawings and as recommended by Manufacturer.

J. Firestops:
1. Horizontal or vertical concealed spaces in walls, light coves, soffits, drop ceilings, and other features over 10 feet in length or height, and at stairs, ceiling levels, floor levels, and other junctures of horizontal to vertical concealed spaces.
2. Within concealed spaces of exterior wall finishes and exterior architectural elements, such as trims, cornices or projections, at maximum intervals of 20 feet, length or height.

K. Sill Plates:
1. Shear Walls and Bearing Walls (structural walls):
   a. Provide specified anchor 12 inches maximum and 4 inches minimum from each end of each plate.
   b. Fasten with anchor bolts embedded in concrete or with post-installed anchors as noted in Contract Drawings.
2. Non-Structural Walls: Fasten with powder actuated fasteners.
3. In addition to requirements of paragraphs '1' and '2' above, set sill plates of interior walls measuring less than 36 inches in length in solid bed of specified construction adhesive, except where sill sealer is used.
4. Install specified seal sealer under sill plates of exterior walls and of acoustically insulated interior walls.

L. Posts And Columns:
1. Unless shown otherwise, nail members of multiple member columns together with 16d at 6 inches on center from each side.

M. Beams And Girders:
1. Built-Up Members:
   a. Stagger individual members of multiple span beams and girders so, over any one support, no more than half the members will have a joint. In all cases, however, joints shall occur over supports.
   b. Unless shown otherwise on Contract Drawings, nail two-ply built-up members with 10d nails 12 inches on center top and bottom, staggered on opposite sides. Nail three-ply built-up ,members with 16d nails at 12 inches on center, top and bottom, staggered, on opposite sides. Set with crown edge up with full bearing at ends and intermediate supports.
2. Pre-Fabricated Members:
   a. Solid glue-lam, LVL, LSL or PSL members may be used in place of built-up 2x framing members. Size shall be same as built-up member.
   b. Solid LVL or PSL members may be used in place of built-up LVL members. Size shall be same as sum of built-up members.
3. Wood shims are not acceptable under ends.
4. Do not notch framing members unless specifically shown in Drawing detail.

N. Nailing:
1. Use nails and nail spacings required by Contract Drawings and:
   a. Top plates: Spiked together, 16d, 16 inches on center.
   b. Top plates: Laps, lap members 48 inches minimum and nail with 16d nails 4 inches on center
   c. Top plates: Intersections, three 16d
   d. Backing and blocking: Three 8d, each end.
   e. Corner studs and angles: 16d, 16 inches on center.

O. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

P. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

Q. Install structural members full length without splices unless otherwise specifically detailed.

R. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and [_____].

S. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

T. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

U. Provide bridging at joists in excess of 8 feet span as detailed. Fit solid blocking at ends of members.

V. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

## 3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fire blocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

## 3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

## 3.06 INSTALLATION OF CONSTRUCTION PANELS (WOOD SHEATHING)

A. Floor Sheathing: 1 Layer Sheathing (floors accessible to public): Glue and nail to framing.
   1. Apply bead of glue to structural supports. Lay face grain / strength axis across supports and with panel continuous over two supports minimum.
   2. Allow expansion gap of at least 1/2 inch at walls.

3. Tongue and Groove.
4. Nail Spacing.
    a. As indicated on Contract Drawings.
5. Thickness:
    a. As indicated on Contract Drawings.
6. Do not install any piece of bottom layer floor sheathing with shortest dimension of less than 24 inches.

B. Subflooring: 2 Layers Sheathing:
1. Bottom layer:
    a. Tongue and Groove.
    b. Glue subflooring layers together along lines of structural supports.
    c. Leave 1/32 inch gap at side and end joints.
    d. Thickness and Nailing: As indicated on Contract Drawings.
    e. Do not install any piece of single layer floor sheathing with shortest dimension of less than 24 inches (600 mm).
2. Top layer:
    a. Tongue and Groove.
    b. Stagger joints of second layer subflooring so they do not line up with joints of first layer subflooring, but do align with intermediate structural member (for example, align with field nailing of bottom subflooring layer).
    c. Glue subflooring layers together along lines of structural supports.
    d. Leave 1/32 inch gap at side and end joints.
    e. Nail at 6 inch centers on ends and 12 inch centers on intermediate structural members.
    f. Thickness and Nailing: As indicated on Contract Drawings.
    g. Do not install any piece of single layer floor sheathing with shortest dimension of less than 24 inches.

C. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
1. At long edges use sheathing clips ("H" clips) where joints occur between roof framing members.
2. At long edges provide solid edge blocking where joints occur between roof framing members where roof is blocked. Refer to Contract Drawings.
3. Nail panels to framing; staples are not permitted.
4. Placing:
    a. Lay face grain at right angles to supports. Provide blocking for support if framing turns at roof overhang.
    b. Provide 1/8 inch (3 mm) space between sheets at end and side joints.
    c. Stagger panel end joints.
    d. Sheathing shall be continuous of two spans minimum.
5. Edge Bearing and Blocking:
    a. As indicated on Contract Drawings.
6. Nail Spacing:
    a. As indicated on Contract Drawings.
    b. Place nails at least 3/8 inch (9.5 mm) in from edge.
7. Thickness:
    a. As indicated on Contract Drawings.
8. Do not install any piece of roof sheathing with shortest dimension of less than 24 inches (600 mm) unless support is provided under all edges.

D. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
1. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches, measured horizontally.

2. Provide inlet diagonal bracing at corners.
3. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.
4. Spacing:
    a. Provide 1/8 inch (3 mm) space between sheets at end and edge joints.
5. Edge Bearing And Blocking:
    a. Panel edges shall bear on framing members and butt along their center lines.
    b. Back block panel edges, which do not bear on framing members, with 2 inch nominal (45 mm) framing.
6. Nail Spacing:
    a. As indicated on Contract Drawings.
    b. Place nails not less than 3/8 inch (9.5 mm) in from edge.
7. Thickness:
    a. As indicated on Contract Drawings.

E. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size: 48 by 96 inches, installed horizontally at ceiling height.
5. Size and Location: As indicated on drawings.

## 3.07 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

## 3.08 FIELD QUALITY CONTROL

A. Field Inspections:
1. Sheathing:
    a. General:
        1) Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
        2) Quality Control is sole responsibility of Contractor as specified in Section 01 4523 ‘Testing And Inspection Services’.
    b. For walls and roof areas where nail spacing is 4 inches and less on center, Inspector shall verify wood panel sheathing, grade, thickness and nominal size of framing members, adjoining panel edges, nail size and spacing, bolting and other fastening of other components.

**END OF SECTION**

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**SECTION 06 1733**
**WOOD I-JOISTS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Wood I-joists for roof and floor framing.

B. Bridging, bracing, and anchorage.

C. Framing for openings.

D. Preservative treatment of wood.

### 1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

B. Section 06 1000 - Rough Carpentry: Material requirements for blocking, plates, and miscellaneous framing.

### 1.03 REFERENCE STANDARDS

A. ASTM D5055 - Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists 2019, with Editorial Revision (2020).

B. PS 1 - Structural Plywood 2009 (Revised 2019).

C. PS 2 - Performance Standard for Wood Structural Panels 2018.

### 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's literature describing materials, dimensions, allowable spans and spacings, bearing and anchor details, bridging and bracing requirements, and installation instructions; identify independent inspection agency.

C. Shop Drawings: Indicate sizes and spacing of joists, bracing and bridging, bearing stiffeners, holes to be cut (if any), and framed openings between joists.

D. Certificate: Certification by joist manufacturer that products delivered are of the same design and construction as those evaluated by the independent inspection agency.

### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in manufacturer's original packaging with manufacturer's name and product identification intact and legible.

B. Protect products from damage due to weather and breakage.

C. Protect joists from warping or other distortion by stacking in upright position, braced to resist movement, with air circulation under coverings and around stacks.

D. Handle individual joists in the upright position.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Suppliers:

1. Builders First Choice, West Jordan, Utah. www.BLDR.com. Contact Dan Egelund:
    a. Office: (801) 224-0541.
    b. Mobile: (801) 376-2385.
    c. E-Mail: Dan.Egelund@bldr.com
2. J. M. Thomas Forest Products, Ogden, UT. www.thomasforest.com. Contact Jordyn Tanner:

a. Office: (800) 962-8780.
b. FAX: 801-782-9652.
c. E-Mail: jordyn@thomasforest.com.

3. Shelter Products, Inc., Portland, OR www.shelter-products.com. Contact Grant Buchanan or Andy Beltz:
   a. Office: (800) 662-3612.
   b. FAX: (503) 238-2663.
   c. E-Mail: gbuchanan@shelter-products.com.
   d. E-mail: abeltz@shelter-products.com.

B. Wood I-Joists:
1. Boise Cascade Company; ____: www.bc.com/#sle.
2. Pacific Woodtech Corporation; ____: https://pwtewp.com/.
3. Weyerhaeuser Company; ____: www.weyerhaeuser.com/#sle.
4. Georgia-Pacific Corp, Atlanta, GA www.gp.com.
5. Jager Industries Inc, Calgary, AB www.jagerbuildingsystems.com.
6. Roseburg Forest Products, Roseburg, OR www.roseburg.com.
7. Trus Joist Corp, Div Weyerhaeuser, Boise, ID www.tjm.com or Surrey, BC (604) 588-7878.
8. Web Joist, Chehalis, WA www.webjoist.com.
9. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 MATERIALS

A. Wood I-Joists: Solid lumber top and bottom flanges and oriented strand board (OSB) webs bonded together with structural adhesive, with published span rating to meet project requirements.
1. Span Rating: Established and monitored in accordance with ASTM D5055 by independent inspection agency.
2. Oriented Strand Board: Comply with PS 2.
3. Plywood: Comply with PS 1.
4. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.
5. Depth: As indicated on drawings.
6. Fabrication Tolerances:
   a. Flange Width: Plus/minus 1/32 inch.
   b. Flange Thickness: Minus 1/16 inch.
   c. Joist Depth: Plus 0, minus 1/8 inch.
7. Marking: Mark each piece with depth, joist spacing, and allowable span for joist spacing.
8. Provide bearing stiffeners if required by span rating or joist hanger manufacturer.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that supports and openings are ready to receive joists.

B. Verify that field measurements are as indicated on shop drawings.

## 3.02 PREPARATION

A. Coordinate placement of bearing items.

## 3.03 ERECTION

A. Install joists in accordance with manufacturer's instructions.

B. Set structural members level and plumb, in correct position.

C. Make provisions for erection loads and for sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Architect.

E. Install permanent bridging and bracing.

F. Install headers and supports to frame openings required.

G. Frame openings between joists with lumber in accordance with Section 06 1000.

H. Coordinate installation of sheathing/decking with work of this section.

**3.04 SITE APPLIED WOOD TREATMENT**

A. Apply preservative treatment in accordance with manufacturer's instructions.

**3.05 TOLERANCES**

A. Framing Members: 1/2 inch maximum, from true position.

**END OF SECTION 06 1733**

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**SECTION 06 1753**
**SHOP-FABRICATED WOOD TRUSSES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Shop-fabricated wood trusses.

B. Truss bridging.

C. Preservative treatment of wood.

### 1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

B. Section 06 1000 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

### 1.03 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 2022.

B. SBCA (BCSI) - Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses 2018 (Updated 2020).

C. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses 1989.

### 1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.

B. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
   1. Include identification of engineering software used for design.
   2. Provide shop drawings stamped or sealed by design engineer.
   3. Submit design calculations.

C. Designer's Qualification Statement.

D. Fabricator's Qualification Statement.

E. Certificates:
   1. Complete and provide copy of certification “Truss Plant Certification Requirements Form” to Architect before bid.
   2. Provide attachment copy of truss plant certification with completed “Truss Plant Certification Requirements Form” to Architect and Testing Agency before commencing fabrication of Wood Trusses.

F. Test And Evaluation Reports:
   1. Copies of previous four quarterly inspection reports verifying compliance with TPI regulations unless the Truss Fabricator provides proof that they are certified and in good standing with the In-Plant WTCA QC program certification.

### 1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design by or under direct supervision of a Professional Structural [_____] Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Metal Connector-Plate Manufacturer Qualifications:
   1. Member of TPI and complies with quality-control procedures in TPI 1 for manufacturer of connector plates.

a. Fabricator’s responsibility includes providing professional engineering services needed to assume engineering responsibility.
b. Engineering responsibility: Preparation of shop drawings and comprehensive engineering analysis by qualified professional engineer registered in location of jurisdiction.

C. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
1. Fabricator must have a letter providing evidence that they are certified and in good standing with their third-party accredited Quality Assurance business.
2. Fabricator shall have in place a program requiring fabrication plant to be inspected four times each year by an independent testing laboratory in accordance with TPI regulations.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A. Handle trusses in accordance with SBCA (BCSI).

B. Store trusses in vertical position resting on bearing ends.

C. Bracing of Metal Plate Connected Wood Trusses’.
1. Trusses may be unloaded by dumping if trusses are shipped horizontally, are rolled off low profile roller bed trailer, and if no part of any truss is required to drop more than 18 inches (450 mm).
2. After delivery of trusses:
a. Inspect for damage before installing trusses.
b. Inspect for “gaps” between framing members.
c. Discard and replace trusses that are damaged or defective.

**PART 2 PRODUCTS**

**2.01 TRUSSES**

A. Performance:
1. Design Criteria:
a. Top and Bottom Chords and Web Members:
1) Designed in accordance with ANSI/TPI 1 for given design loads.
b. Metal Gusset Plates:
1) Plate design and manufacture shall be as approved by 'The Research Committee for the ICC'.
2) Truss plates for symmetrical trusses shall be same size on both sides of truss. Determine size to be used by highest loading value on either side of truss.

**2.02 MATERIALS**

A. Lumber:
1. Moisture Content: Between 7 and 9 percent.
2. Lumber fabricated from old growth timber is not permitted.

B. Metal Gusset Plates:
1. Connector plates to comply with TPI 1 from hot-dip galvanized steel sheet complying with ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch (0.914 mm) thick.
a. Use for interior locations.
2. Manufacturer's name or trademark shall be visible on plates.
3. Approved Manufacturers. See Section 01 6200 for definitions of Categories:
a. Eagle Metal Products, Dallas, TX www.eaglemetal.com.
b. ITW Building Components Group, Glenview, IL www.itwbcg.com.
c. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc. Chesterfield, MO www.mii.com or MiTek Canada, Bradford ON www.mii.com/canada.

d. Simpson AS Truss Connector Plates; Simpson Strong-Tie Company Inc. Pleasanton, CA www.strongtie.com.

C. Fabrication:
1. General:
a. Fabrication of trusses shall be as approved by ICC except that this Specification shall govern when it exceeds ICC requirements.
b. Fabricate trusses from approved shop drawings.
c. Fabricate trusses in jigs with members accurately cut to provide good bearing at joints.

D. Joints shall be acceptable if the average opening between ends of members immediately after fabrication is less than 1/16 inch.
1. Each chord section shall be involved in two (2) panel points before being spliced.
2. Metal Gusset Plates:
a. No panel point shall have more than one (1) plate per truss side.
b. Plates shall have minimum bite of 2-1/2 inches on members. Measure bite along center line of webs and perpendicular to chord axes. Orient plate axis parallel with truss chord axis except where chords change pitch or terminate. Plates may be placed parallel with webs at single web joints.
1) Minimum bite requirements are waived for non-structural webs parallel to top chords added for insulation backing and for other non-structural members.
2) Minimum bite requirements are waived for truss blocking.
c. Plate Sizes:
1) Minimum width of plates shall be 3 inches.
(a) Minimum bite requirements are waived for non-structural webs parallel to top chords added for insulation backing.
(b) Minimum width requirements are waived for truss blocking.
2) For flat bottom chord trusses, size plates for 110 percent of member forces. For scissor trusses, size plates for 150 percent of member forces. If webs are double cut, plates are to be sized for additional 10 percent of the member forces.
3) Size plates, nail and steel section for 110 percent of member forces.
4) No increase in plate values will be allowed for duration of loading or other factors.
d. Press plates into members to obtain full penetration without crushing outer surface of wood. Plate embedment is acceptable if opening between plate and wood surface is less than 1/32 inch.
e. Lumber defects and plate misplacement, in combination, shall not reduce plate area or number of effective teeth, prongs, or nails by more than ten percent.
f. Do not apply metal gusset plates after shop fabrication.

E. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

**2.03 ACCESSORIES**

A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: As specified in Section 06 1000.

**2.04 WOOD TREATMENT**

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that field measurements are as indicated.

B. Verify that supports and openings are ready to receive trusses.

## 3.02 PREPARATION

A. Coordinate placement of bearing items.

## 3.03 ERECTION

A. Install trusses in accordance with manufacturer's instructions, SBCA (BCSI); maintain a copy of applicable documents on site until installation is complete.

B. Set members level and plumb, in correct position.

C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

D. Do not field-cut or alter structural members without approval of Architect.

E. Install permanent bridging and bracing.

F. Install headers and supports to frame openings required.

G. Frame openings between trusses with lumber in accordance with Section 06 1000.

H. Coordinate placement of decking with work of this section.

I. After erection, touch-up primed surfaces with primer consistent with shop coat.

## 3.04 SITE-APPLIED WOOD TREATMENT

A. Treat all site-sawn cuts of pressure-treated wood using same type of treatment (i.e. preservative or fire-retardant).

B. Apply preservative treatment to non-pressure-treated wood wherever it will come into contact with cementitious materials, roofing, asphaltic materials, or metals.

C. Apply treatment in accordance with manufacturer's instructions.

D. Allow field-applied treatment to dry prior to erecting members.

## 3.05 TOLERANCES

A. Framing Members: 1/2 inch maximum, from true position.

## 3.06 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
   1. Prefabricated Metal Plate Connected Wood Trusses:
      a. Testing Agency will obtain “Truss Plant Certification Requirements Form” attachment copy from Architect as per requirements of Section 06 1753 - Shop-Fabricated Wood Trusses: Trusses Rafters.
      b. Inspector shall verify that temporary installation restraint/bracing and permanent individual truss member restraint/bracing are installed in accordance with approved truss submittal package

## 3.07 ATTACHMENTS

A. Truss Plant Certification Requirements Form

**END OF SECTION**

**SECTION 06 1753.01**
**TRUSS PLANT CERTIFICATION REQUIREMENTS FORM**

Metal Plate Connected Wood Truss suppliers shall be certified as evidenced by submittal of a copy of the truss plant certification with this completed form to the Architect and Testing Agency before commencing fabrication of Wood Trusses.

Metal Plate Connected (MPC) wood truss operations must design, manufacture and provide quality control and quality audits that comply with the latest edition of ANSI/TPI-1 promulgated by the Truss Plate Institute.

The truss plant must be certified by an independent third party accredited Quality Assurance business such as, but not limited to, the Truss Plate Institute (TPI); the Southern Pine Inspection Bureau, the Timber Products Inspection Bureau or the PFS Corp. The third party accredited Quality Assurance business must be under the auspices of the International Accreditation Services (IAS) or the American National Standards Institute (ANSI) and be ISO/IES Standard 17020 compliant. The inspection/audit process is to be completely independent of the truss manufacturer.

Truss plant shall fulfill the following requirements (see www.sbcindustry.com and www.tpinst.org or www.tpic.ca):

_____ Shall have an independent and accredited third party inspection agency (Quality Assurance business) staff member visit the truss plant for the certification, and shall have at least one inspection done quarterly by an independent third party inspection agency that is itself certified.

_____ Shall meet all necessary in-plant requirements including: The Acceptance Criteria for Quality Documentation (ICC AC-10) by the ICC Evaluation Service, Inc. which shall include the quality control requirements of the Product Standard of ANSI / TPI. Meeting the ANSI / TPI standard includes having an in-plant quality control manual, quality control procedures in place, and meeting the weekly inspection frequency.

_____ Do inspections at the required frequency and of the type established by the certification program. Specifically as a minimum, three trusses per set up location per shift per week.

_____ Not manufacture trusses or use components that do not comply with the requirements of this form and of the Contract Documents.

_____ Provide proof of compliance to the requirements of this form and provide the proof to the General Contractor who will forward it to the Architect prior to the truss plant providing a bid.

OR

Truss plant shall be certified and be in good standing with the In-Plant WTCA QC program. This includes the following requirements (see www.sbcindustry.com and www.tpinst.org or www.tpic.ca):

_____ Truss plant has been trained by SBCA on the ANSI/TPI 1 QC standard.

_____ Truss plant has quarterly third party inspections, and that the third party has been trained by SBCA.

_____ Truss plant has quality control manual that meets the AC-10 requirements.

_____ Truss plant has quality control procedures in place including: meeting the weekly inspection frequency, performing detailed inspections, and documenting any inspection problems and how they were resolved.

_____ Truss plant is sending their data quarterly to SBCA for review.

_____ Truss plant shall not manufacture trusses or use components that do not comply with the requirements of this form and of the Contract Documents.

In-Plant WTCA QC certified plants are listed at www.sbcindustry.com/wtcaqccertco.php.

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**SECTION 06 1800**
**GLUED-LAMINATED CONSTRUCTION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Glue laminated wood beams and purlins.

B. Preservative treatment of wood.

C. Steel hardware and attachment brackets.

### 1.02 REFERENCE STANDARDS

A. AITC 117 - Standard Specifications for Structural Glued Laminated Timber of Softwood Species 2010.

B. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber 2007.

C. ANSI A190.1 - Product Standard for Structural Glued Laminated Timber 2022.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

G. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.

H. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2021a.

I. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions 2012a (Reapproved 2018).

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.

K. AWPA U1 - Use Category System: User Specification for Treated Wood 2022.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

M. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber 2019.

N. SPIB (GR) - Standard Grading Rules 2021.

O. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2018.

P. WWPA G-5 - Western Lumber Grading Rules 2021.

### 1.03 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.

B. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings, and [_____].
   1. Submit design calculations signed and sealed by design engineer.

C. Designer's Qualification Statement.

D. Manufacturer's Qualification Statement.

### 1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design structural members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience, and certified by AITC in accordance with AITC A190.1.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect members to AITC requirements for individually wrapped.

# PART 2 PRODUCTS

## 2.01 MANUFACTURERS

A. Glued-Laminated Structural Units:
   1. Approved Suppliers.
      a. Builders First Choice, West Jordan, UT. www.BLDR.com. Contact Dan Egelund:
         1) Office: (801) 224-0541.
         2) Mobile: (801) 376-2385.
         3) E-Mail: Dan.Egelundr@bldr.com
      b. J. M. Thomas Forest Products, Ogden, UT. www.thomasforest.com. Contact Tom Karren:
         1) Office: (800) 962-8780.
         2) FAX: 801-782-9652.
         3) E-Mail: tom@thomasforest.com.
      c. Shelter Products, Inc., Portland, OR www.shelter-products.com. Contact Grant Buchanan or Andy Beltz:
         1) Office: (800) 662-3612.
         2) Cell: NA.
         3) FAX: (503) 238-2663.
         4) E-Mail: gbuchanan@shelter-products.com.
         5) E-mail: abeltz@shelter-products.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 GLUED-LAMINATED UNITS

A. Glued-Laminated Units: Fabricate in accordance with AITC 117 Industrial grade.
   1. Verify dimensions and site conditions prior to fabrication.
   2. Cut and fit members accurately to length to achieve tight joint fit.
   3. Fabricate member with camber built in.
   4. Do not splice or join members in locations other than those indicated without permission.
   5. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.
   6. Welding: Perform welding in accordance with AWS D1.1/D1.1M.
   7. After end trimming, seal with penetrating sealer in accordance with AITC requirements.

## 2.03 MATERIALS

A. Lumber: Softwood lumber complying with RIS (GR) grading rules with 12 percent maximum moisture content before fabrication. Design for the following values, unless noted otherwise on Contract Drawings:
   1. Bending (Fb): [_____] psi.
   2. Tension Parallel to Grain (Ft): [_____] psi.
   3. Compression Parallel to Grain (Fc): [_____] psi.
   4. Compression Perpendicular to Grain Bottom (Fc1): [_____] psi.
   5. Compression Perpendicular to Grain Top (Fc1): [_____] psi.
   6. Horizontal Shear (Fv): [_____] psi.
   7. Modulus of Elasticity (E): [_____] psi.

B. Steel Connections and Brackets: ASTM A36/A36M weldable quality, galvanize per ASTM A123/A123M.

C. Anchor Bolts: ASTM F3125/F3125M, Type 1 heavy hex high strength bolts and ASTM A563 (ASTM A563M) nuts; hot-dip galvanized to meet requirements of ASTM A153/A153M, matching washers.

D. Laminating Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.

E. Wood Sealer: [_____].

F. Bearing Plate Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

**2.04 WOOD TREATMENT**

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Preservative Pressure Treatment:
   1. Preservative Pressure Treatment of Glued-Laminated Structural Units: AWPA U1, Use Category UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
      a. Kiln dry lumber after treatment and before lamination to maximum moisture content of 19 percent.
   2. Marking: Marked each piece with stamp of an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

**2.05 FABRICATION**

A. Fabricate glue laminated structural members in accordance with AITC Industrial grade. At locations exposed in public areas: Architectural Grade.

B. Fabricate beams in accordance with requirements of ANSI A190.1.

C. Camber beams to radius of 2000 ft unless shown otherwise on Contract Drawings.

D. Welding: Perform welding in accordance with AWS D1.1/D1.1M.

E. Verify dimensions and site conditions prior to fabrication.

F. Cut and fit members accurately to length to achieve tight joint fit.

G. Fabricate member with camber built in.

H. Do not splice or join members in locations other than those indicated without permission.

I. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.

J. After end trimming, seal with penetrating sealer in accordance with AITC requirements.

K. Field Finishing of Members: Specified in Section 09 9113 and 09 9123.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that supports are ready to receive units.

B. Verify sufficient end bearing area.

**3.02 PREPARATION**

A. Coordinate placement of bearing items.

**3.03 ERECTION**

A. Lift members using protective straps to prevent visible damage.

B. Set structural members level and plumb, in correct positions or sloped where indicated.

C. Provide temporary bracing and anchorage to hold members in place until permanently secured.

D. Fit members together accurately without trimming, cutting, splicing, or other unauthorized modification.

E. Swab and seal the interior wood surfaces of field drilled holes in members with primer.

**END OF SECTION**

**SECTION 06 2000**
**FINISH CARPENTRY**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood shelving.

D. Wood casings and moldings.

E. Miscellaneous plastic fabrications.

F. Hardware and attachment accessories.

G. Fire-rated door frames.

### 1.02 RELATED REQUIREMENTS

A. Section 06 6116 - Solid Surfacing Fabrications - Countertops

B. Section 09 9113 - Exterior Painting: Painting of finish carpentry items.
   1. Section 09 9123 - Interior Painting: Painting of finish carpentry items.

C. Section 09 9300 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

### 1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

### 1.04 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.

### 1.05 SUBMITTALS

A. Product Data:
   1. Provide manufacturer's product data, color selection, storage and handling instructions for factory-fabricated units.
   2. Provide data on fire retardant treatment materials and application instructions.
   3. Provide instructions for attachment hardware and finish hardware.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Samples:
   1. Interior Hardwood for Transparent Finish:

a. Before performing work of this Section, prepare Control Sample, to match sample available from Owner, to be used as finishing standard for interior clear finished hardwood as specified in Section 09 9324.
b. Design Criteria:
1) Provide 8 inch by 10 inch (200 mm by 255 mm) sample of Red Oak to match Owner provided stain color selected for Project.
2) Control Sample will be used as performance standard for evaluating finish provided.

2. Source Quality Control Submittals:
a. Samples:
1) Interior Hardwood for Transparent Finish:
(a) Owner will provide Control Sample for finish.

3. Samples: Submit two samples of finish plywood, __12__x__12__ inch in size illustrating wood grain and specified finish.
4. Samples: Submit two samples of wood trim __6__ inch long.

## 1.06 QUALITY ASSURANCE

A. Fabricators:
1. Blue Mountain Millwork and Cabinetry, 198 North 4700 East, Rigby, ID 83442.
a. Contact Information: Chris Newson or Gabe Ceja, phone (208) 538-7415
e-mail bids@BluMtnMillwork.com, gabec@BluMtnMillwork.com
2. Michael Seiter & Co., Inc., P.O. Box 315 Heber City, UT 84032.
a. Contact Information: Mark Seiter phone (435) 654-0601 fax (435) 654-0613
e-mail mark@msandcoinc.com.
3. Thompson and Sons Cabinets, 11834 N. 3400 West, Deweyville, UT 84309.
a. Contact Information: David Thompson cell (435) 230-0876 office (435) 257-7152
e-mail zcabinets@comcast.net.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
3. Single Source Responsibility: Provide and install this work from single fabricator.

## 1.07 WARRANTY

A. Manufacturer Extended Warranty:
1. Approved Fabricator's written guarantee that all Goods and Services will be free from defects in materials and workmanship for a period of five (5) years from date of substantial completion.

## 1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect from moisture damage.

# PART 2 PRODUCTS

## 2.01 DESIGN CRITERIA

A. Design Criteria:
1. General:

a. AWS Custom Grade is minimum acceptable standard, except where explicitly specified otherwise, for materials, construction, and installation of architectural woodwork.

2. Materials:
   a. Lumber:
      1) Grade:
         (a) No defects in boards smaller than 600 sq in.
         (b) One defect per additional 150 sq inches in larger boards.
         (c) Select pieces for uniformity of grain and color on exposed faces and edges.
         (d) No mineral grains accepted.
      2) Allowable Defects:
         (a) Tight knots not exceeding 1/8 inch in diameter. No loose knots permitted.
         (b) Patches (dutchmen) not apparent after finishing when viewed beyond 18 inches.
         (c) Checks or splits not exceeding 1/32 inch by 3 inches and not visible after finishing when viewed beyond 18 inches.
         (d) Stains, pitch pockets, streaks, worm holes, and other defects not mentioned are not permitted.
         (e) Normal grain variations, such as cats eye, bird's eye, burl, curl, and cross grain are not considered defects.
      3) Use maximum lengths possible, but not required to exceed 10 feet without joints. No joints shall occur closer than 72 inches in straight runs exceeding 18 feet. Runs between 18 feet and 10 feet may have no more than one joint. No joints shall occur within 72 inches of outside corners nor within 18 inches of inside corners.
      4) Moisture content shall be six (6) percent maximum at fabrication. No opening of joints due to shrinkage is acceptable.

B. Fabrication:
   1. Follow Architectural Woodwork Standards (AWS) for fabrication of Architectural Woodwork.
   2. Tolerances:
      a. No planer marks (KCPI) allowed. Sand wood members and surfaces with 100 grit or finer.
      b. Maximum Gap: None allowed.
      c. Flushness Variation: 0.015 inch maximum.
      d. Sanding Cross Scratches: 1/4 inch maximum.
      e. Plug screw holes. Screw locations not to be visible beyond 18 inches.
   3. Fabricate work in accordance with measurements taken on job site.
   4. 'Ease' sharp corners and edges of exposed members to promote finishing and protect users from slivers. Radius of 'easing' shall be uniform throughout Project and between 1/32 and 1/16 of an inch.
   5. Fabricate so veneer grain is vertical.
   6. Joints:
      a. Use lumber pieces with similar grain pattern when joining end to end.
      b. Compatibility of grain and color from lumber to panel products is required.
   7. Install hardware in accordance with Manufacturer's directions. Leave operating hardware operating smoothly and quietly.

8. Remove or repair damaged surface of or defects in exposed finished surfaces of architectural woodwork to match adjacent similar undamaged surface.

## 2.02 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.
   2. Casings, stops, handrails, and jambs.
   3. Chair rails.
   4. Fixed shelving not part of casework.
   5. Folding panel partition hardwood jambs and trim.
   6. Hardwood base.
   7. Hardwood handrail at Rostrum Riser and/or Rostrum Ramp.
   8. Hardwood trim at light coves, speaker cabinets, etc.
   9. Hardwood trim for wall covering.
   10. Pass-through window wood trim.
   11. Wood trim at ceiling trim.

C. Wood Stair: Materials:
   1. Treads:
      a. 5/4 inch clear Douglas Fir or Southern Pine, or 1-1/8 inch thick high density particle board preformed stair tread.
      b. Treads to have 1/2 inch radius at top outside edge.
   2. Risers: 4/4 inch clear Douglas Fir or Southern Pine, or 3/4 inch plywood.

## 2.03 LUMBER MATERIALS

A. Performance / Design Criteria: Conform to requirements of Section 06 4001 'Common Architectural Woodwork Requirements'.
   1. Glue: Waterproof and of best quality.
   2. Factory-finish to match Owner selected sample as specified in Section 09 9324.

B. Architectural Woodwork Wood Trim:
   1. Interior Hardwood For Transparent Finish:
   2. Design Criteria:
      a. Solid wood shall be plain sawn Red Oak.
      b. Paneling shall be panel product with plain sliced Red Oak veneer.
      c. Finish to match Owner selected sample as specified in Section 09 9300.
         1) Color:
            (a) Color Oak 95..

C. Interior Wood For Opaque, Painted Finish:
   1. Applies to ceiling trim only.
   2. Solid wood shall be any species allowed by AWS Custom grade.

## 2.04 SHEET MATERIALS

A. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

1. For Transparent Finish:
    a. Paneling shall be panel product with plain sliced Red Oak veneer.
        1) Color Oak 95.

## 2.05 PLASTIC MATERIALS

A. Materials:
1. Acrylic Solid Surface:
    a. Approved Manufacturers. See Section 01 6000.
        1) Corian by DuPont Co, Wilmington, DE. Contact Steve Finch at (314) 941-5179 or email stephen.m.finch@dupont.com.
        2) Staron Solid Surfacing by Cheil Industries / Samsung Chemical USA, La Mirada, CA www.staron.com.
        3) 'Gibraltar Solid Surface' by Wilsonart International Inc, Temple, TX www.wilsonart.com
2. Acrylic Solid Surface Window Stools:
    a. Design Criteria:
        1) Meet requirements of ANSI/ICPS SS-1.
    b. General:
        1) 1/2 inch thick 100 percent acrylic polymer.
    c. Approved Color Qualty Standards: As selected by Architect from Manufacturer's standard solid (white or off white only) colors.
        1) Bone by Corian
        2) Glacier White by Corian.
        3) Bisque by Corian.
        4) Cameo White by Corian.
        5) Vanilla by Corian.
3. High Density Polyethylene (HDPE):
    a. Acceptable Products:
        1) Comtec Industries, Moosic, PA www.comtecindustries.com.
        2) PSiSC, Columbia, SC www.psisc.com.
    b. High Density Polyethylene (HDPE) Bench Seat:
        1) 1-1/2 inches thick.
        2) Color selected to closely match color of toilet partitions.

## 2.06 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

## 2.07 HARDWARE

A. Manufacturer Contact List:
1. Blum Inc, Stanley, NC www.blum.com.
2. Bommer Industries, Landrum, SC www.bommer.com.
3. ClosetMaid, a division of Emerson Electric, Ocala, Florida www.closetmaid.com
4. CompX National, Mauldin, SC www.nclnet.com.
5. Dow Chemical, Midland, MI www.dow.com.
6. Flynn & Enslow, San Francisco, CA www.flynnenslow.com.
7. Grass America Inc, Kernersville, NC www.grassusa.com.
8. Hafele America Co., Archdale, NC hafele.com.

9. Hillside Wire Cloth Co., Inc., Bloomfield, NJ www.hillsidewirecloth.com.
10. Ives, Indianapolis, IN www.iveshardware.com.
11. Knape & Vogt, Grand Rapids, MI www.knapeandvogt.com or Knape & Vogt Canada, Mississaugua, ON (905) 676-8972.
12. Olympus Lock Co, Seattle, WA www.olympus-lock.com.
13. Owens Corning, Toledo, OH www.owens-corning.com.
14. Salice America Inc, Charlotte, NC www.saliceamerica.com.
15. SOSS Door Hardware (Division of Universal Industrial Products Company) Pioneer OH www.soss.com.
16. Stanley, New Britain, CT www.stanleyhardware.com or Oakville, ON (800) 441-1759.
17. TWP Inc., Berkley, CA www.twpinc.com.
18. Wire Cloth Manufacturers Inc., Mine Hill, NJ www.wireclothman.com.

B. Coat and Hat Hook: No. 405, A92 finish, by Ives.

C. Wardrobe Hooks (Coat and Hat Hooks) (mounted below Coat and Hat Rack): 581 by Ives.

D. Shelf Standards: 87WH extra heavy duty standard by Knape & Vogt.

E. Decoration Anchors:
1. Bright zinc plated lag eyebolts, wire size 4, 3-7/8 inches minimum total length.
2. 8414 by Stanley.

F. Shelf Brackets: 187WH extra heavy duty brackets by Knape & Vogt. Size according to shelf width, end of bracket to be within 2 inches (50 mm) of front edge of shelf.

**2.08 FABRICATION**

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. General Architectural Woodwork Installation:
1. Fabricate work in accordance with measurements taken on Project site.
2. Scribe, miter, and join accurately and neatly to conform to details.
3. Exposed surfaces shall be machine sanded, ready for finishing.
4. Allow for free movement of panels.
5. Countersink nails. Countersink screws and plug those exposed to view.
6. Attach custom casework as specified in Sections under 06 4000 Heading: 'Furnishing of Architectural Woodwork' to wall blocking with #10 x 3 inch minimum Cabinet Screws. Attach wall cabinets with screws equally spaced horizontally not to exceed 12 inches O.C. with 3 inch maximum spacing at cabinet edges.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Shelves:
1. Design Criteria:
a. Conform to applicable requirements of Sections 06 4001.
b. Fabricate the work of this section to AWS 'Custom Grade'.
c. Species as acceptable for AWS 'Custom Grade'.
2. Material:
a. Panel Product:
1) Glues (adhesives) used in manufacture and fabrication of panel products shall be Type I or II.
2) Moisture content shall be same as specified for lumber.

3) Cores:
   (a) All Other: Industrial grade particle board with minimum density of 45 lbs per cu ft.
4) Facings:
   (a) All facings shall be Melamine or Kortron.
5) Thickness:
   (a) 30 Inch Span And Less: 3/4 inch thick.
   (b) Spans Over 30 Inches To 42 Inches: One inch thick.
   (c) Spans Over 42 inches: One inch thick and provide equal center supports.

b. Edgings:
   1) Use 3/4 inch Kortron or Melamine faced Panel Product with hot glued 3 mm thick PVC with eased edges. Apply banding on all four edges of adjustable shelving and on exposed edges of fixed shelving, with one-inch return onto unexposed edges.
   2) Edge banding color to match Panel Product.

c. Shelf Supports In Storage Building: 1x4 solid stock Pine, C or better, S4S.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

### 3.02 INSTALLATION

A. AWS Custom Grade is minimum acceptable standard, except where explicitly specified otherwise, for installation of architectural woodwork.

B. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

C. Install hardware in accordance with manufacturer's written instructions.

### 3.03 INSTALLATION OF ACCESSORIES

A. Coat and Hat Hooks:
   1. Mount coat hook on Office side of Office doors in center of door, 54 inches from finish floor to top of hook base.

B. Wardrobe Hooks (Coat and Hat Hooks) (mounted below Coat and Hat Rack):
   1. As shown in Contract Drawings.

### 3.04 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

### 3.05 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9113 and 09 9123.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

### 3.06 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 06 2000**

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**SECTION 06 4100**
**ARCHITECTURAL WOOD CASEWORK**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Preparation for installing utilities.

### 1.02 RELATED REQUIREMENTS

A. Section 06 6116 - Solid Surfacing Fabrications

B. Section 08 8000 - Glazing: Glass for casework.

### 1.03 REFERENCE STANDARDS

A. ANSI/BHMA A156.11 - Cabinet Locks; 2019.

B. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source; 2022.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

F. WDMA I.S. 6A - Interior Architectural Wood Stile and Rail Doors; 2013.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the efforts of the various trades affected by the Work of this Section.
   2. Coordinate completion of 2x6 (50mm x 100mm) wall blocking for custom casework.
   3. Coordinate completion of custom casework.
   4. Coordinate order, delivery, and installation of all casework

### 1.05 SUBMITTALS

A. Certificates:
   1. Provide Manufacturer's certification of compliance to ANSI/NEMA LD 3.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
      a. Include plan and elevation views, materials used, standing and running trim profiles, assembly methods, joint details, fastening methods, accessories, and hardware.
   2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   3. Fabricator First Submittal:
      a. Provide 1/4 inch (or larger) scale building layout and/or description of required room walls required for field dimension for Field Quality Control Submittal. Provide submittal before rough framing is completed.
   4. Fabricator Second Submittal:
      a. Provide shop drawings for cabinet and casework that are included for project showing details, casework locations and layout and required dimensions based on Field

Quality Control Submittals for compliance to Contract Drawings for approval to Project Architect.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
   1. Before performing work of this Section, prepare Control Sample, to match sample available from Owner, to be used as finishing standard for interior clear finished hardwood as specified in Section 09 9324.
   2. Provide 8 inch by 10 inch (200 mm by 255 mm) sample(s) of Red Oak to match Owner provided stain color selected for Project.
   3. Control Sample will be used as performance standard for evaluating finish provided.

F. Closeout Submittals:
   1. Record Documentation:
      a. Manufacturer's literature for plastic laminate.
      b. Color selections.

## 1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Fire-Test-Response Characteristics: Provide plastic laminate with surface burning characteristics as determined by testing identical products by qualified testing agency.
      a. Surface-Burning Characteristics:
   2. Plastic Laminate shall have Class A flame spread rating in accordance with ASTM E84 or UL 723 Type 1.
      a. Class A (Flame spread index 0-25; Smoke-developed index 0-450).
      b. Flash point: None.

B. Mockups:
   1. Before fabrication of complete casework package, submit section or sections of cabinetry containing typical drawer, shelving, cabinet door panel, and hardware.
   2. Match Owner provided selected sample finish specified in Section 09 9324.
   3. Mockups may be installed in Project after approval.

C. Approved Fabricators:

D. Approval subject to agreement process approval.
   1. Blue Mountain Millwork and Cabinetry, 198 North 4700 East, Rigby, ID 83442
      a. Contact Information: Chris Newson or Gabe Ceja, phone (208) 538-7415 e-mail bids@BluMtnMillwork.com, gabec@BluMtnMillwork.com
   2. Michael Seiter & Co., Inc., P.O. Box 315 Heber City, UT 84032.
      a. Contact Information: Mark Seiter phone (435) 654-0601 fax (435) 654-0613 e-mail mark@msandcoinc.com.
   3. Thompson and Sons Cabinets, 11834 N. 3400 West, Deweyville, UT 84309.
      a. Contact Information: David Thompson cell (435) 230-0876 office (435) 257-7152 e-mail zcabinets@comcast.net.

E. Alternate Fabricator:
   1. Equal as approved by Architect.

F. Fabricator Qualifications

1. Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
2. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
3. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
4. Firm experience in supplying products indicated for this Project.
5. Firm with sufficient production capacity to produce required units.
6. Firm will comply with specifications and Contract Documents for this Project.
7. Minimum five (5) years experience in Woodwork installations.
8. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and installation procedures required for this project before bidding.
9. Upon request by Architect or Owner, submit documentation.

### 1.07 MOCK-UPS

A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

B. Mock-up may remain as part of the work.

### 1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

B. Delivery And Acceptance Requirements:
   1. Fabricator Responsibility:
      a. Assemble architectural woodwork at Architectural Woodwork Fabricator's plant and deliver ready for erection insofar as possible.
      b. Protect architectural woodwork from moisture and damage while in transit to job site.
   2. General Contractor Responsibility:
      a. Report damaged materials received within two (2) days from delivery at project site.

C. Storage And Handling Requirements:
   1. General Contractor Responsibility:
      a. Unload and store in place where it will be protected from moisture and damage and convenient to use.

### 1.09 WARRANTY

A. Manufacturer Extended Warranty:
   1. Approved Fabricator’s written guarantee that all Goods and Services will be free from defects in materials and workmanship for a period of five (5) years from date of substantial completion for all architectural woodwork.

## PART 2 PRODUCTS

### 2.01 DESIGN CRITERIA

A. Design Criteria:
   1. General:
      a. AWS Custom Grade is minimum acceptable standard, except where explicitly specified otherwise, for materials, construction, and installation of architectural woodwork.
   2. Materials:
      a. Lumber:
         1) Grade:
            (a) No defects in boards smaller than 600 sq in.

(b) One defect per additional 150 sq inches in larger boards.
(c) Select pieces for uniformity of grain and color on exposed faces and edges.
(d) No mineral grains accepted.

2) Allowable Defects:
(a) Tight knots not exceeding 1/8 inch in diameter. No loose knots permitted.
(b) Patches (dutchmen) not apparent after finishing when viewed beyond 18 inches.
(c) Checks or splits not exceeding 1/32 inch by 3 inches and not visible after finishing when viewed beyond 18 inches.
(d) Stains, pitch pockets, streaks, worm holes, and other defects not mentioned are not permitted.
(e) Normal grain variations, such as cats eye, bird's eye, burl, curl, and cross grain are not considered defects.

3) Use maximum lengths possible, but not required to exceed 10 feet without joints. No joints shall occur closer than 72 inches in straight runs exceeding 18 feet. Runs between 18 feet and 10 feet may have no more than one joint. No joints shall occur within 72 inches of outside corners nor within 18 inches of inside corners.

4) Moisture content shall be six (6) percent maximum at fabrication. No opening of joints due to shrinkage is acceptable.

B. Fabrication:
1. Follow Architectural Woodwork Standards (AWS) for fabrication of Architectural Woodwork.
2. Tolerances:
a. No planer marks (KCPI) allowed. Sand wood members and surfaces with 100 grit or finer.
b. Maximum Gap: None allowed.
c. Flushness Variation: 0.015 inch maximum.
d. Sanding Cross Scratches: 1/4 inch maximum.
e. Plug screw holes. Screw locations not to be visible beyond 18 inches.
3. Fabricate work in accordance with measurements taken on job site.
4. 'Ease' sharp corners and edges of exposed members to promote finishing and protect users from slivers. Radius of 'easing' shall be uniform throughout Project and between 1/32 and 1/16 of an inch.
5. Fabricate so veneer grain is vertical.
6. Joints:
a. Use lumber pieces with similar grain pattern when joining end to end.
b. Compatibility of grain and color from lumber to panel products is required.
7. Install hardware in accordance with Manufacturer's directions. Leave operating hardware operating smoothly and quietly.
8. Remove or repair damaged surface of or defects in exposed finished surfaces of architectural woodwork to match adjacent similar undamaged surface.

## 2.02 COMPONENTS

A. Design Criteria:
1. General:
a. Except as noted otherwise, fabricate the work of this section according to AWS - ‘Custom Grade’ is the minimum acceptable standard.
1) Cabinet door wood grain direction shall run vertically and all doors shall be set matched.

2) Cabinet drawer front wood grain direction may run vertically or horizontally, with same direction maintained on all cabinet or elevation of cabinets.

b. Casework Construction Type:
1) Type B: Face-frame construction where front edge of cabinet body components are overlaid with frame.

c. Door interface style:
1) Type B Construction: Flush Overlay.

2. Solid Stock:
a. Exposed: Plain sawn Red Oak.
b. Semi-exposed And Concealed: Species as acceptable for AWS 'Custom Grade'.

3. Panel Product:
a. Glues (adhesives) used in manufacture and fabrication of panel products shall be Type I or II.
b. Moisture content shall be same as specified for lumber.
c. Cores:
1) Cabinet Doors: Medium density fiberboard (MDF) with minimum density of 48 lbs per cu ft.
2) All Other: Industrial grade particle board with minimum density of 45 lbs per cu ft.
d. Facings:
1) Hardwood veneer facings shall be plain sliced Red Oak AWS Grade A, or equal by HPVA, WDMA, or APA.
2) All other facings shall be Melamine or Kortron.
e. Edgings:
1) Cabinet Doors And Drawer Fronts Higher Than 8 Inches (200 mm):
(a) 3/4 inch by 1/8 to 1/4 inch (19 mm by 3 to 6 mm) edge-banding of wood species matching hardwood face veneer.
2) Shelves And Exposed Panel Product Edges:
(a) Hot-glued, 3 mm thick, PVC edge-banding. Wood-grain, except color matching Melamine or Kortron surface at shelf edges.
3) Semi-Exposed Panel Product Edges:
(a) Hot-glued, 3 mm thick, wood grained PVC edge-banding.

4. Casework Doors:
a. Face Veneer:
1) Design Criteria:
(a) Plain sliced Red Oak meeting requirements of AWS Grade A, 1/50 inch (0.5 mm) thick minimum immediately before finishing.
(b) Face veneers shall be running book matched.
b. Doors under 1-3/8 inch (35 mm) thick: Panel Product.
c. Doors 1-3/8 inch (35 mm) or more thick:
1) Door Grade: AWS Custom hollow-core.
2) Stiles:
(a) 1-1/4 inches (32 mm) deep minimum before fitting.
(b) 1/4 inch (6 mm) minimum of stile face to be hardwood matching face veneer material.
3) Rails:
(a) 1-1/8 inches (28.5 mm).
(b) Mill option material.

## 2.03 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Components:

1. Design Criteria:

a. General:

1) Except as noted otherwise, fabricate the work of this section according to AWS 'Custom Grade'.

(a) Cabinet door wood grain direction shall run vertically and all doors shall be set matched.

2) Casework Construction Type:

(a) Type B: Face-frame construction where front edge of cabinet body components are overlaid with frame.

3) Door interface style:

(a) Type B Construction: Flush Overlay.

b. Solid Stock:

1) Exposed: Plain sawn Red Oak.

2) Semi-exposed And Concealed: Species as acceptable for AWS 'Custom Grade'.

c. Panel Product:

1) Glues (adhesives) used in manufacture and fabrication of panel products shall be Type I or II.

2) Moisture content shall be same as specified for lumber.

3) Cores:

(a) Cabinet Doors: Medium density fiberboard (MDF) with minimum density of 48 lbs per cu ft (769 kg per cu meter).

(b) All Other: Industrial grade particle board with minimum density of 45 lbs per cu ft (721 kg per cu meter).

4) Facings:

(a) Hardwood veneer facings shall be plain sliced Red Oak AWS Grade A, or equal by HPVA, WDMA, or APA.

(b) All other facings shall be Melamine or Kortron.

5) Edgings:

(a) Cabinet Doors And Drawer Fronts Higher Than 8 Inches (200 mm):

(1) 3/4 inch by 1/8 to 1/4 inch (19 mm by 3 to 6 mm) edge-banding of wood species matching hardwood face veneer.

2. Shelves And Exposed Panel Product Edges:

(1) Hot-glued, 3 mm thick, PVC edge-banding. Wood-grain, except color matching Melamine or Kortron surface at shelf edges.

(b) Semi-Exposed Panel Product Edges:

(1) Hot-glued, 3 mm thick, wood grained PVC edge-banding.

b. Casework Doors:

1) Face Veneer:

(a) Design Criteria:

(1) Plain sliced Red Oak meeting requirements of AWS Grade A, 1/50 inch (0.5 mm) thick minimum immediately before finishing.

(2) Face veneers shall be running book matched.

2) Doors under 1-3/8 inch (35 mm) thick: Panel Product.

3) Doors 1-3/8 inch (35 mm) or more thick:

(a) Door Grade: AWS Custom hollow-core.
(b) Stiles:
(1) 1-1/4 inches (32 mm) deep minimum before fitting.
(2) 1/4 inch (6 mm) minimum of stile face to be hardwood matching face veneer material.
(c) Rails:
(1) 1-1/8 inches (28.5 mm).
(2) Mill option material.

C. Fabrication:
1. Fabricators:
a. Approved Fabricators. See Section 06 4001 for Category Three Approved Fabricators.
2. Cabinet Body:
a. Use AWS Flush Overlay construction on cabinet bodies.
b. If used, install Rail System adjustable shelf supports recessed.
3. Drawers:
a. Fabricate with separate, screw-attached drawer front.
b. Joints shall be dowel and pressure-glued, or lock shoulder, glued, and pin nailed.
c. Set bottoms into sides, backs, and subfront with 1/4 inch (6 mm) deep groove with 3/8 inch (9.5 mm) minimum standing shoulder.
d. Every drawer shall have specified drawer guides and pull installed. Install drawer guides with 'Euroscrews', and pulls with through-bolts passing through both front and sub-front.
4. Cabinet Doors:
a. Full height, panel product cabinet doors may be fabricated in two pieces and joined on back with metal backplate. Backplate shall match interior door surface color.
b. Hinges: Install hinges using plastic insertion dowels for hinges and 'Euroscrews' for baseplates.
c. Every cabinet door shall have specified pull installed.
5. Cabinet Component Thickness And Material:
a. Use hardwood veneer facing on panel product, except on following surfaces:
1) Where Kortron or Melamine shall be used.
2) Cabinet exposed interiors surfaces (not including cabinet doors) and shelving faces behind cabinet doors in all rooms.
3) Cabinet semi-exposed surfaces.
4) Cabinet concealed surfaces.
5) Cabinet exposed exteriors permanently concealed (not exposed to view).
6) Drawer sides, backs, bottoms, and subfronts.
b. Ends, Divisions, Bottoms, Tops: 3/4 inch (19 mm) thick panel product.
c. Rails: 3/4 inch (19 mm) thick panel product.
d. Shelves:
1) Panel product.
2) Thickness:
(a) 30 Inch (750 mm) Span And Less: 3/4 inch (19 mm) thick.
(b) Spans Over 30 Inches (750 mm) To 42 Inches (1 050 mm): One inch (25 mm) thick.
(c) Spans Over 42 inches (1 050 mm): One inch (25 mm) thick and provide Hafele or equal center supports.

e. Backs: 1/4 inch (6 mm) thick panel product.
f. Doors: 3/4 inch (19 mm) thick panel product.
g. Drawer Sides, Backs, And Subfronts: 1/2 inch (12.7 mm) thick minimum panel product.
h. Drawer Bottoms: 1/4 inch (6 mm) thick panel product.
i. Separate Drawer Front:
1) 8 Inches (200 mm) High And Less: 3/4 inch (19 mm) thick solid hardwood.
2) More Than 8 Inches (200 mm) High: 3/4 inch (19 mm) panel product.
j. Hardboard Dividers: 1/4 inch (6 mm) thick panel product.
k. Hardboard Shelves: 1/8 inch (3 mm) thick hardboard, smooth both sides.
6. Cabinet and Drawer Locks:
a. Install only on cabinets and drawers as shown on Contract Documents.
7. Install plastic grommets in cable access holes in countertops located as located on Contract Documents.
8. Install Hardware Cloth as shown on Contract Drawings at Scripture Cabinet kick space used as return air grille.

D. Finishes:
1. Factory Finishing:
a. Design Criteria:
1) Applied before leaving factory.
2) Factory-finish to match Owner selected sample as specified in Section 09 9324.
b. Color:
1) OAK 95.

E. Plastic Laminate Faced Architectural Cabinets:
1. Manufacturers:
a. Manufacturer Contact List:
1) Accuride, Santa Fe Springs, CA www.accuride.com.
2) Blum Inc, Stanley, NC www.blum.com.
3) CompX National, Mauldin, SC www.nclnet.com.
4) Formica, Cincinnati, OH www.formica.com.
5) Grass America Inc, Kernerville, NC www.grassusa.com.
6) Hafele America Co., Archdale, NC hafele.com.
7) Ives, Indianapolis, IN www.iveshardware.com.
8) Knape & Vogt, Grand Rapids, MI www.knapeandvogt.com.
9) Nevamar, Odenton, MD www.nevamar.com.
10) Olympus Lock Co, Seattle, WA www.olympus-lock.com.
11) Salice America Inc, Charlotte, NC (800) 222-9652 or (704) 841-7810 www.saliceamerica.com.
12) Stanley, New Britain, CT www.stanleyhardware.com.
2. Components:
a. Design Criteria:
1) General:
(a) Except as noted otherwise, fabricate the work of this section to AWS ‘Custom Grade’.
b. Panel Product:
1) Glues (adhesives) used in manufacture and fabrication of panel products shall be Type I or II.
2) Moisture content shall be same as specified for lumber.

3) Cores:
   (a) Cabinet Doors: Medium density fiberboard (MDF) with minimum density of 48 lbs per cu ft (769 kg per cu meter).
   (b) All Other: Industrial grade particle board with minimum density of 45 lbs per cu ft (721 kg per cu meter).
4) Edgings:
   (a) Shelves and Exposed Panel Product Edges:
   (b) Hot-glued, 2 mm thick minimum, PVC edge-banding.
   (c) Wood-grained or solid color to match cabinet, except color matching Melamine or Kortron surface at shelf edges.
   (d) Semi-Exposed Panel Product Edges:
   (e) Hot-glued, 0.018 inch (0.46 mm) thick minimum, PVC edge-banding, wood grained or solid color to match cabinet.
   (f) PVC with 5/32 inch (3.97 mm) slot.
   (g) Color: Black.
   (h) Size: 1-1/2 inches (38 mm).
   (i) Type Two Acceptable Products:
      (1) Model 4542 by Charter Industries.
      (2) Equal as approved by Architect before installation. See Section 01 6000.

c. Cabinet Component Thickness and Material:
   1) Use plastic laminate facing on panel product, except on following surfaces, where Kortron or Melamine shall be used.
      (a) Cabinet interiors and shelving faces behind cabinet doors in all rooms.
      (b) Cabinet interiors and shelving faces always open to view.
      (c) Cabinet exteriors permanently concealed.
      (d) Drawer sides, backs, bottoms, and sub-fronts.

## 2.04 COUNTERTOPS

A. Design criteria of countertops: See Section 06 6116, Solid Surfacing Fabrications

## 2.05 ACCESSORIES

A. Manufacturer Contact List for Accessories:
   1. Accuride, Santa Fe Springs, CA www.accuride.com.
   2. Anybumper, Amite, LA www.Anybumper.com.
   3. Blum Inc, Stanley, NC www.blum.com.
   4. CompX National, Mauldin, SC www.nclnet.com.
   5. Flynn & Enslow, San Francisco, CA www.flynnenslow.com.
   6. Glynn Johnson, Chicago, IL www.glynn-johnson.com.
   7. Grass America Inc, Kernerville, NC www.grassusa.com.
   8. Hafele America Co., Archdale, NC hafele.com.
   9. Hillside Wire Cloth Co., Inc., Bloomfield, NJ www.hillsidewirecloth.com.
   10. Ives, Indianapolis, IN www.iveshardware.com.
   11. Knape & Vogt, Grand Rapids, MI www.knapeandvogt.com or Knape & Vogt Canada, Mississaugua, ON (905) 676-8972.
   12. Salice America Inc, Charlotte, NC www.saliceamerica.com.
   13. Stanley, New Britain, CT www.stanleyhardware.com.
   14. TWP Inc., Berkley, CA www.twpinc.com.
   15. Wire Cloth Manufacturers, Inc., Mine Hill, NJ www.wireclothman.com.

B. Support Post:
   1. Acceptable Product:
      a. Model TL28R-390 by Doug Mockett & Company, Inc. Torrance, CA www.mockett.com.
      b. Description:
         1) Round support post for removable countertop as shown in Contract Documents.
      c. Design Criteria:
         1) Size: 28-1/2 inch (724 mm) table leg, 3 inch (76 mm) diameter.
         2) Recessed glide leveler.
         3) Cold rolled steel.
         4) Polished and painted.
         5) Color: Polished chrome.
      d. Equal as approved by Architect before installation. See Section 01 6000.

C. Pass-Through Window Track Assembly:
   1. Aluminum track with nylon or ball bearing steel rollers. Bottom track is not to extend above surface of counter when installed.
   2. Acceptable Products:
      a. Standard Installation Ezy-Roll Aluminum Track Number P1092 ANOD by Knape and Vogt, which includes:
         1) 1085 vinyl glides: Four (4) each.
         2) 1093 upper channel: One (1) each.
         3) 1095 shoe: Two (2) each.
         4) 1097 rollers: Four (4) each.
         5) 1099 lower track: One (1) each.
      b. Equal as approved by Architect before bidding. See Section 01 6000.

D. Sliding Window Lock:
   1. Provide with 4 keys.
   2. Quality Standard: Number 965 NP Rachet Lock by Knape & Vogt.

## 2.06 HARDWARE

A. Cabinet Hardware:
   1. Cabinet And Drawer Pulls:
      a. Satin Chromium Plated brass / bronze core bow handles, 4 inches (100 mm) long minimum.
      b. Acceptable Products:
         1) 4484 by Stanley.
   2. Cabinet And Drawer Locks:
      a. General:
         1) Pin tumbler type suitable for location.
         2) Keying: Key each cabinet and drawer individually as shown on Contract Documents except as follows:
            (a) Key each cabinet and drawer within each Office alike.
            (b) Crosskey knife drawer in Serving Area so all other cabinet and drawer keys will open drawer.
         3) Stamp keys with Room number and cabinet designation as shown on Signage Plan of Contract Drawings.
         4) Provide six (6) keys per cabinet.
      b. Design Criteria:

1) Barrel diameter: 7/8 inch (22 mm).
2) Cylinder length: 7/8 inch (22 mm).
3) Key removable in locked or unlocked position.
4) Meet ANSI/BHMA A156.11 Grade 2 requirements.

c. Acceptable Manufacturers:
1) Advantage Plus cam lock by CompX National Lock.
2) 100DR/200DW N Series door and drawer lock by Olympus Lock Inc.
3) Equal as approved by Architect before installation. See Section 01 6200.

3. Cabinet Adjustable Shelf Supports:
a. Either of following systems are acceptable, at Fabricator's option:
1) 32mm System: Casework Fabricator's standard.
2) Traditional System:
(a) Quality Standards: 255 and 256 by Knape & Vogt.

B. Cabinet Door Bumpers:
1. Description:
a. Polyurethane bumper to protect gypsum board from cabinet handle damage where cabinet handles hit gypsum wallboard surface.
2. Design Criteria:
a. Clear.
b. Peel adhesion.
c. Size: 3/8 inch (9.5 mm diameter x 1/8 inch (3 mm) thick.
3. Acceptable Products:
a. WS-34 Cylindrical Soft Durometer Cabinet Bumper by Anybumper.

C. Scripture Cabinet Hardware Cloth (at kick space used as return air grille):
1. Hardware (Wire) Cloth:
a. Design Criteria:
1) Plain Weave Wire Cloth.
2) Metal Type: Galvanized after welded.
3) 1/2 inch (12.7 mm) x 1/2 inch (12.7 mm) Mesh.
4) Wire Gauge: 16.
b. Quality Standard Manufacturers:
1) Flynn & Enslow.
2) Hillside Wire Cloth.
3) TWP.
4) Wire Cloth Manufacturers.

D. Material Center Gate Hardware:
1. Acceptable Products:
a. Hinges: Two (2) required.
1) BB 1279 by Hager Companies.
2) TB 2714 by Mckinney.
3) FBB 179 by Stanley.
b. Gate Latch: One (1) required:
1) Secret Gate Latch 989 by Knape & Vogt.
c. Silencers: Two (2) required:
1) GJ 65 by Glynn Johnson.
2) 308D by Hager Companies.
3) 21 by Ives.

4) 1229 B by Trimco.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

C. Inspections:

D. Clear Finished Hardwood:

E. Color matches Owner provided sample specified in Section 09 9324.

### 3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

H. Site glaze glass materials using Interior Dry method; see Section 08 8000.

### 3.03 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

### 3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

**END OF SECTION 06 4100**

**SECTION 06 4115**
**ROSTRUM CASEWORK**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Products Furnished but not Installed Under This Section:
   1. Rostrum casework as described in Contract Documents consisting of the following:
      a. Chapel Pulpit (with adjustable lift mechanism).
      b. Control Pedestal.
      c. Lectern (Free Standing) for Primary Room.
      d. Lectern (Table Top) for Relief Society.
      e. Modesty Rail.
      f. Ramp Landing Sidewall.
      g. Riser Steps Sidewall.
      h. Rostrum Riser Handrail (floor mounted).
      i. Sacrament Table.
      j. Wood Handrails and Handrail Brackets.
      k. Movable Chapel Pulpit (without adjustable lift mechanism) with interlocking Side Panels.
      l. Lectern (Free Standing) for Primary Rooms.
      m. Lectern (Table Top) for Relief Society.

B. Related Requirements:
   1. Section 05 5213 - 'Pipe and Tube Railing' for floor mounted Rostrum Riser Handrail and Rostrum Ramp Handrail.
   2. Section 06 1000 - 'Rough Carpentry' for wall blocking required for Rostrum Casework.
   3. Section 06 2000 - 'Finish Carpentry':
      a. Installation of Rostrum Casework.
   4. Section 06 4100 - 'Architectural Wood Casework':
      a. Approved Fabricators.
      b. General standards for materials and fabrication of Architectural Woodwork.
      c. Action Submittals for shop drawings from Fabricator.
      d. Field Quality Control Submittals for field dimensions provided to Fabricator from Contractor.
   5. Section 09 9300 - 'Staining and Transparent Finishing'.

### 1.02 REFERENCES

A. Association Publications:
   1. Architectural Woodwork Institute / Architectural Woodwork Manufacturers Association of Canada / Woodwork Institute, 46179 Westlake Drive, Suite 120, Potomac Falls, VA www.awinet.org.
      a. Architectural Woodwork Standards (AWS), 2nd Edition, 2014.

B. Definitions:
   1. Face Veneer: The outermost exposed wood veneer surface of a veneered wood door, panel, or other component exposed to view when the project is completed.
   2. Grade: Unless otherwise noted, this term means Grade rules for Economy, Custom, and/or Premium Grade:
      a. Custom Grade: Typically specified for and adequately covers most high-quality architectural woodwork, providing a well-defined degree of control over a project's quality of materials, workmanship, or installation.

3. Plain-Sawn: A hardwood figure developed by sawing a log lengthwise at a tangent to the annual growth rings. It appears as U-shaped or straight markings in the board's face.
4. Running Match: Each panel face is assembled from as many veneer leaves as necessary. Any portion left over from one panel may be used to start the next.

C. Reference Standards:
1. International Electrotechnical Commission (IEC):
a. IEC 60529 (ed. 2.1 b:2001), 'Degrees of protection provided by enclosures (IP Code).
2. International Organization for Standards (ISO):
a. ISO 3746:2010, 'Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane'.

## 1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2019).

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the efforts of the various trades affected by the Work of this Section.
2. Coordinate completion of 2x6 (50mm x 100mm) wall blocking for rostrum casework.
3. Coordinate completion of electrical and audio video wiring with rostrum casework.
4. Coordinate completion of rostrum casework.

B. Sequencing:
1. Install rostrum casework after following has been completed:
a. Adjacent millwork.
b. Adjacent walls and ceilings are finished.

## 1.05 SUBMITTALS

A. Action Submittals:
1. Shop Drawings:
a. As specified in as specified in Action Submittals in Section 06 4100 - 'Architectural Wood Casework'.
2. Samples:
a. Interior Hardwood for Transparent Finish:
1) Approval subject to Annual Review:
(a) Prepare sample to match Control Sample available from Owner to be used as finishing standard for interior clear finished hardwood as specified in Section 09 9300.
(b) Approval of sample by Owner will establish performance standard of stain to be used until next annual review.
2) Design Criteria:
(a) Provide 8 inch by 10 inch (200 mm by 255 mm) sample of Red Oak to match stain Control Sample provided by Owner.

B. Informational Submittals:
1. Source Quality Control Submittals:
a. Samples:
1) Interior Hardwood for Transparent Finish:
(a) Owner will provide Control Sample for finish.
2. Field Quality Control Submittals:

a. Field dimensions:
1) Contractor Responsibility:
(a) Provide field dimensions of Rostrum area to Approved Fabricator as specified in Field Quality Control Submittal in Section 06 4100 - 'Architectural Wood Casework'.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Warranty Documentation:
1) Final, executed copy of Warranty.

## 1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Assemble Rostrum Casework at Architectural Woodwork Fabricator's plant and deliver ready for erection insofar as possible.
2. Protect Rostrum Casework from moisture and damage while in transit to job site.
3. Report damaged materials received.

B. Storage And Handling Requirements:
1. Unload and store in secure place where it will be protected from moisture and damage and convenient to use.

## 1.07 WARRANTY

A. Manufacturer Extended Warranty:
1. Approved Fabricator’s written guarantee that all Goods and Services will be free from defects in materials and workmanship for a period of five (5) years from date of substantial completion.

B. Adjustable Lift Mechanism:
1. Lift Manufacturer’s warranty against defects in materials and workmanship.

# PART 2 PRODUCTS

## 2.01 MANUFACTURED UNITS

A. Description:
1. Rostrum casework consists:
a. Chapel Pulpit (with adjustable lift mechanism).
b. Control Pedestal.
c. Lectern (Free Standing) for Primary Room.
d. Lectern (Table Top) for Relief Society.
e. Modesty Rail.
f. Ramp Landing Sidewall.
g. Riser Steps Sidewall.
h. Sacrament Table.
i. Wood Handrails and Handrail Brackets.
2. Rostrum casework as described in Contract Documents consisting of the following:
a. Moveable Chapel Pulpit (without adjustable lift mechanism) with Side Panels.
b. Lectern (Free Standing) for Primary Rooms.
c. Lectern (Table Top) for Relief Society.

B. Design Criteria:
1. AWS Custom Grade is minimum acceptable standard for materials, construction, and installation of architectural woodwork.

2. Interior Hardwood for Transparent Finish. Furnish factory-finish matching Owner selected sample for Rostrum Casework:
    a. Design Criteria:
        1) Factory-finish to match Owner selected sample as specified in Section 09 9300.
    b. Color:
        1) OAK 95.

C. Materials:
1. Rostrum Casework as described in Contract Documents.
    a. Material:
        1) Solid Wood: Plain sawn Red Oak.
        2) Paneling: Panel Product with plain sliced Red Oak veneer.
    b. Rostrum Rail:
        1) Running match construction.
        2) Fabricator Option:
            (a) Option A: One (1) 3/4 inch (19 mm) 'A' face veneer panel product both sides.
            (b) Option B: Two (2) 1/2 inch (12.7 mm) 'A' face veneer one side panel product laminated together.
    c. End (Wing) Supports:
        1) No butcher block (edge grain construction) permitted.
2. Wood handrails and brackets.

D. Fabrications:
1. Following Architectural Woodwork Standards (AWS) for fabrication of Rostrum casework.
2. Fabricators:
    a. Approved Fabricators. See Section 06 4100 for Approved Fabricators.

## 2.02 ACCESSORIES

A. Adjustable Pulpit Mechanism:
1. Description:
    a. Lift Mechanism for raising and lowering pulpit / podium lecterns including but not limited to following components:
        1) Column assembly.
        2) Control box.
        3) Control cable.
        4) Control relay assembly.
        5) Lift Actuator.
2. Design Criteria:
    a. General:
        1) Identification;
            (a) Each unit shall have tag permanently attached giving Model Number and Manufacturer's name, phone number, and address.
        2) Service Life:
            (a) Estimated service life of Lift Mechanism shall be one (1) million cycles plus/minus ten (10) percent.
        3) Sound:
            (a) Lift mechanism must operate at not more than 48db(A) measured per ISO 3746.
    b. Dimension Requirements:

1) Provide Lift Mechanism within lectern neck and engage not more than 18 inches (450 mm) and not less than less than 17 inches (430 mm).
2) Provide Lift Mechanism to fit inside lectern (size is based which Manufacturer provided original pulpit mechanism):
(a) 8-3/4 to 9 inch (222 to 230 mm) square by 18 inch (450 mm).
3) Do not exceed 3 inches (75 mm) minimum or 6 inches (150 mm) maximum space from bottom of lectern to top of pulpit base.

c. Safety switch assembly.
d. Switches, condensers, etc, shall be only those supplied by Manufacturer.
e. Surge Protector.

3. Column Assembly:
a. General:
1) Construct Lift Mechanism with inner and outer column.
2) Inner column must be fixed to base plate of Lift Mechanism.
3) Connect outer column to inner column with system of roller bearings to provide vertical motion but limit lateral motion.
b. Material:
1) Construct inner and outer column dimensionally stable material for presence of variable humidity levels (typically aluminum).
2) Protect inner and outer column from oxidation with an electrolytic coating such as powder coat paint or anodize.

4. Control Box:
a. General:
1) Electrical components of unit shall be UL/ULC, CSA, and/or TUV listed or recognized where such listing or recognition is available.
2) Actuator and power supply must meet requirements of IEC 60529 for IP51 protection.
3) Cut-off mechanism must automatically reset after operation.
b. Power Supply:
1) Power supply for operating motor of actuator must be separate from actuator and Lift Mechanism.
2) Power supply mains cable must be available with molded plug end for interface with standard outlets without use of adapters.
3) Power supply must meet worldwide voltage and frequency requirements.

5. Control Cable:
a. Separate interconnection cables used to connect screw actuator, control switch and power to power supply unit.
b. Interconnection cables must be uniquely sized, keyed, and pinned so that incorrect connection to power supply unit cannot be completed.
c. Locking mechanism must be supplied to prevent interconnection cables from being removed from the power supply without disabling lock mechanism.

6. Lifting Actuator:
a. Provide movable outer column with screw type actuator.
1) Outer column must not be physically connected to screw type actuator.
b. Screw Type Actuator:
1) Provide sealed and lubricated for life of actuator.
2) Provide end of stroke limit switches contained with actuator.
3) Provide brake mechanism to prevent screw from back driving under load.

4) Actuator must extend and/or retract at minimum speed of 1/2 inch (12.7 mm) per second.

7. Safety Switch Assembly:
   a. Provide adjustable cut-off mechanism to limit weight that Lift Mechanism can carry during extension:
      1) Lift Mechanism to carry total weight of 55 lb (24.9 kg) to 65 lb (29.5 kg) including weight of pulpit lectern and neck assembly.
   b. Provide adjustable cut-off mechanism to limit force that may be transmitted to an obstruction object during retraction:
      1) Force should not exceed 3 lbs (1.36 kg) when measured between top of pulpit cabinet and front left corner of lectern.
8. Approved Product. See Section 01 6000 and Section 01 4000 for Qualification Requirements:
   a. Manufacturer Contact List:
      1) Mark Eaton LLC, American Fork, UT www.markeatonllc.com.
         (a) Contact Information: Mark Eaton (801) 756-5639.
      2) Techna-Base , Inc., Pleasant Grove, UT.
         (a) Contact Information: Dewey Lundahl (801) 785-6477 or (801) 361-2289 (cell).
   b. Approved Product:
      1) Mark Eaton:
         (a) Model LDS2005A by Mark Eaton.
      2) Techna-Base.
         (a) Model PL-120 (120 VAC) or Model PL-220 (220 VAC).

**2.03 SOURCE QUALITY CONTROL**

A. Inspections:
   1. Clear Finished Hardwood:
      a. Color matches Owner provided sample specified in Section 09 9300.

**PART 3 EXECUTION: NOT USED**

**END OF SECTION 06 4115**

**SECTION 06 6116**
**SOLID SURFACING FABRICATIONS**

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes: Provide solid surfacing fabrications including but not limited to following:
   1. windowsills.
   2. lavatory tops with seamed bowls.
   3. vanity tops.
   4. millwork countertops with sinks and cove backsplashes.

B. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
   1. Waste management and disposal requirements: Section 01 74 19, Waste Management and Disposal.
   2. Provision of indoor air quality requirements: Section 01 81 19, Indoor Air Quality Requirements.
   3. Provision of finish carpentry: Section 06 20 00, Finish Carpentry.
   4. Provision of architectural woodwork: Section 06 41 00, Architectural Woodwork.
   5. Provision of elastomeric joint sealants: Section 07 92 00, Joint Sealants.
   6. Provision of tile work: Section 09 30 00, Tiling.
   7. Provision of wall coverings: Section 09 72 00, Wall Coverings.
   8. Provision of plumbing and plumbing fixtures: Division 22, Plumbing.

### 1.02 REFERENCES

A. Abbreviations and Acronyms:
   1. MDF: Medium Density Fiberboard.
   2. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov
   3. VOC: Volatile Organic Compound.

B. Definitions:
   1. Solid Surface: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

**C. REFERENCE STANDARDS:**
   1. ANSI/NPA A208.2-09 - Medium Density Fiberboard (MDF) For Interior Applications
   2. ASTM C920-14a - Standard Specification for Elastomeric Joint Sealants
   3. ASTM D638-10 - Standard Test Method for Tensile Properties of Plastics
   4. ASTM D785-08 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
   5. ASTM D790-10 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
   6. ASTM D5420-10 - Standard Test Method for Impact Resistance of Flat, Rigid, Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
   7. ASTM E84-14 - Standard Test Method for Surface Burning Characteristics of Building Materials
   8. ASTM E228-11 - Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer

9. ASTM G21-13 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

10. ASTM G22-76(96) - Standard Practice for Determining Resistance of Plastics to Bacteria

11. NFPA 255-06 - Standard Method of Test of Surface Burning Characteristics of Building Materials

12. NSF/ANSI 51-07 - Food Equipment Materials

13. SCAQMD Rule 1168 - Adhesive and Sealant Applications (amended January 2005)

14. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials

15. UL Environment/ GREENGUARD/ UL 2818 - Standard for Chemical Emissions for Building Materials, Finishes and Furnishings, Section 7.1

16. UL Environment/ GREENGUARD/ UL 2818 - Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings, Section 7.1 and 7.2

17. UL 2824 - GREENGUARD Certification Program, Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers

## 1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meetings: Arrange pre-installation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Architect. Presided over by Contractor, include Architect who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

## 1.04 SUBMITTALS

A. Product Data: Indicate Product description including solid surface sheets, sinks, bowls and illustrating full range of standard colors, fabrication information and compliance with specified performance requirements. Submit Product data with resistance to list of chemicals.

B. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. Indicate plans, sections, dimensions, component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid surface.

C. Coordination Drawings: Submit coordination drawings indicating plumbing and miscellaneous steel work indicating locations of wall rated or non-rated, blocking requirements, locations and recessed wall items and similar items.

D. Samples: Submit samples in accordance with Section 01 30 00. Submit minimum 6" x 6" samples. Cut sample and seam together for representation of inconspicuous seam. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.

## 1.05 CLOSEOUT SUBMITTALS

### A. OPERATIONAL AND MAINTENANCE DATA:

1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in Project closeout documents.
2. Provide a commercial care and maintenance kit and video. Review maintenance procedures and warranty details with Owner upon completion.

## 1.06 QUALITY ASSURANCE

**A. QUALIFICATIONS:**

1. Installers: Provide work of this Section executed by competent installers with a minimum 5 years of experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

**B. MOCK-UPS:**

1. Prior to final approval of Shop Drawings, erect 1 full size mock-up of each component at Project site demonstrating quality of materials and execution for Architect review.
2. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from Project site.
3. Approved mock-up will be used as standard for acceptance of subsequent work.
4. Approved mock-ups may remain as part of finished work.

## 1.07 DELIVERY, STORAGE AND HANDLING

**A. DELIVERY AND ACCEPTANCE REQUIREMENTS:**

1. Deliver no components to Project site until areas are ready for installation.

**B. STORAGE AND HANDLING REQUIREMENTS:**

1. Store components indoors prior to installation.
2. Handle materials to prevent damage to finished surfaces.

## 1.08 WARRANTY

**A. MANUFACTURER WARRANTY:**

1. Provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Architect and at no expense to Owner.

# PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

A. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

1. Corian® by DuPont; www.corian.com
1. Wilsonart; www.wilsonart.com
2. Formica (Everform Solid Surface): www.formica.com
3. Hanex: www.hanex.com

B. Approved Color Quality Standards. See Section 01 6200 for definition of Categories:

1. Restrooms: (Select color that best coordinates with the combination of floor tile, wall tile, and metal toilet partitions selected for project.)
   a. Corian: Bone for windowsills, stonique for countertop

2. Clerks' Office, Resource Center, Sacrament Preparation, and Serving Area: (Select color that best coordinates with the flooring and millwork combination selected for project.)
   a. Bone for windowsills, stonique for countertop

## 2.02 MATERIALS

**A. DESCRIPTION:**

1. Sustainability Characteristics:

a. EQc4.1: Provide adhesives and sealants with VOC quantities lower than stated in SCAQMD Rule 1168. Ensure VOC quantities for sealants do not exceed 250 g/l under any circumstances.

**B. PERFORMANCE/DESIGN CRITERIA:**

| | PROPERTY | REQUIREMENT (MIN OR MAX) | | TEST PROCEDURE |
|---|---|---|---|---|
| 1. | Solid Surface Based Products: | | | |
| a. | Tensile Strength | 6000 psi min | | ASTM D638 |
| b. | Tensile Modulus | 1.5 x $10^6$ psi min | | ASTM D638 |
| c. | Tensile Elongation | 0.4% min. | | ASTM D638 |
| d. | Flexural Strength | 10000 psi min | | ASTM D790 |
| e. | Flexural Modulus | 1.2 x $10^6$ psi min | | ASTM D790 |
| f. | Hardness | >85-Rockwell "M" scale min. | | ASTM D785 |
| g. | Thermal Expansion | 2.2 x $10^{-5}$ in./in./°F | | ASTM E228 |
| h. | Fungi and Bacteria | Does not support microbial growth | | ASTM G21 & G22 |
| i. | Microbial Resistance | Highly resistant to mold growth | | UL 2824 |
| j. | Ball Impact | No fracture - 1/2 lb. Ball:<br>6 mm slab - 36" drop<br>12 mm slab - 144" drop | | NEMA LD 3, Method 3.8 |
| k. | Weatherability | ΔE*94<5 in 1,000 hrs | | ASTM G155 |
| l. | Flammability | | | ASTM E84, NFPA 255 & UL 723 |
| | | **All Colors** | | |
| | | **6 mm** | **12 mm** | |
| m. | Flame Spread | <25 | <25 | |
| n. | Smoke Developed | <25 | <25 | |
| o. | Class | A | A | NFPA 101®, Life Safety Code |

**C. SOLID SURFACE MATERIAL:**

1. Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria:

2. Flammability: Class 1 and A when tested to UL 723.

3. Food Equipment Material Compliance: Food Zone to NSF/ANSI 51.

a. Ensure material has minimum physical and performance properties specified under "Performance/Design Criteria".

b. Ensure superficial damage to a depth of 0.010" is repairable by sanding and polishing.

4. Adhesive for Bonding to Other Products: One component silicone to ASTM C920.

5. Sealant: A standard mildew-resistant, FDA/UL® and NSF/ANSI 51 compliant in Food Zone area, recognized silicone color matched sealant or clear silicone sealants.

7. Heat Reflecting Tape: Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

8. Insulating Nomex® Fabric: Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

## 2.03 COMPONENTS

A. Windowsills: 1/2" thick solid surfacing material, adhesively joined with inconspicuous seams, edge details as indicated on Drawings. Bone for windowsills, stonique for countertop. See Spec Section 06 2000 Finish Carpentry

B. Counter Perimeter Frame: Ensure 1/2" or 3/4" thick, moisture resistant cores for counter tops in wet areas having sinks or lavatories are 3/4" thick exterior grade plywood with waterproof adhesive, Fir or Poplar plywood, veneer core only. Front apron = 1 ½" thick

C. Lavatory Tops with Seamed Bowls: 1/2" or 3/4" thick countertop of solid polymer solid surfacing material, cast to desired profiles and sizes having edge details as indicated on Drawings conforming to CSA B45.5/IAPMO Z124, complete with seamed "S" undermount bowl. Provide countertops complete with backsplashes of size shown on Drawings. Ensure countertop and backsplash is color; single color as selected by Architect. Ensure 5 bowls are model. Front apron = 1 ½" thick

E. Fabrication

1. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
2. Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
3. Ensure no blistering, whitening and cracking of components during forming.
4. Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings. Backsplashes for most colors may be fabricated by traditional means discussed in K-25294 Backsplashes. Colors with metallic/mica particle or veined colors creating directional aesthetics (K-26833 Directional Aesthetics) may require the techniques in Technical Bulletin K-28235 Thermoformed Backsplash.
5. Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 1.97 inch wide reinforcing strip of solid polymer material under each joint.
6. Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.
7. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
8. Finish: Ensure surfaces have uniform finish:
   a. Matte, with a 60° gloss rating of 5 - 20.
9. Fabrication Tolerances:
   a. Variation in Component Size: +/-1/8".
   b. Location of Openings: +/-1/8" from indicated location.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verification of Conditions:

1. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Verify actual site dimensions and location of adjacent materials prior to commencing work.

3. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 1/8" in 10' - 0".

4. Notify Architect in writing of any conditions which would be detrimental to installation.

5. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

**3.02 INSTALLATION**

A. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.

B. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.

C. Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's written recommendations using adhesive in color to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.

D. Install countertops with no more than 1/8" sag, bow or other variation from a straight line.

E. Adhere undermount/sub-mount/bevel mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.

F. Adhere top-mount sinks/bowls to countertops using manufacturer recommended adhesives and color-coordinated silicone sealant. Secure seam mount bowls and sinks to counter tops using color matched joint adhesive.

G. Seal between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.

H. Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard color-coordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard color-matched silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard color-coordinated joint adhesive.

I. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Completion of the Work.

J. Coordinate connections of plumbing fixtures with Division 22. Make plumbing connections to sinks in accordance with Division 22.

**3.03 REPAIR**

A. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Technical Bulletins".

**3.04 SITE QUALITY CONTROL**

A. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

**3.05 CLEANING**

A. Remove excess adhesive and sealant from visible surfaces.

B. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

**3.06 PROTECTION**

A. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.

B. Protect surfaces from damage until date of Substantial Completion of the Work.

**END OF SECTION 06 6116**

**SECTION 07 1113**
**BITUMINOUS DAMPPROOFING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Bituminous dampproofing.

### 1.02 SUBMITTALS

A. Product Data: Provide properties of primer, bitumen, and mastics.

B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

### 1.03 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

## PART 2 PRODUCTS

### 2.01 BITUMINOUS DAMPPROOFING

A. Acceptable Products:
   1. Ecomul-11 by Epro Waterproofing Systems, Derby, KS www.eproserv.com.
   2. Henry 788 by Henry Company, El Segundo, CA www.henry.com.
   3. Karnak 100 by Karnak Chemical Corp, Clark, NJ www.karnakcorp.com.
   4. Sealmastic Asphalt Emulsion Dampproofing Type I by W R Meadows, Hampshire, IL www.wrmeadows.com.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

### 3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

### 3.03 APPLICATION

A. Spray Application:
   1. Spray to a thickness of 10 mils (0.254 mm) minimum.

B. Brush / Roller Application:
   1. Apply two coats of dampproofing at rate recommended by Manufacturer.
   2. Apply coats in cross hatch method so coats are applied perpendicular to each other.
   3. Before applying second coat allow first coat to dry in accordance with Manufacturer's recommendations.

C. Prime surfaces in accordance with manufacturer's instructions.

D. Apply from 6 inches below finish grade elevation down to top of footings.

E. Seal items watertight with mastic, that project through dampproofing surface.

F. Do not backfill against bituminous dampproofing for twenty-four (24) hours after application.

**END OF SECTION**

**SECTION 07 2100**
**THERMAL INSULATION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Board insulation.

B. Batt insulation.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

### 1.02 RELATED REQUIREMENTS

A. Section 07 2600 - Vapor Retarders: Separate vapor retarder materials.

B. Section 07 2700 - Air Barriers: Separate air barrier materials.

### 1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2022.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2022a.

D. ASTM C764 - Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation 2019.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

### 1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

B. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

### 1.05 QUALITY ASSURANCE

A. Pre-Installation Conferences:
   1. Participate in pre-installation conference as specified in Section 01 3100:
      a. Schedule pre-installation conference prior to commencement of installing insulation with Installer and Manufacturer’s Representative if available.
      b. In addition to agenda items specified in Section 01 3100, review following:
         1) Review installation procedures.
         2) Review coordination of work with related and adjacent work.
         3) Review special details and flashing.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Thermal Insulation Manufacturers:
   1. Certainteed Corp, Valley Forge, PA www.certainteed.com.
   2. FiberTEK, Salt Lake City, UT www.fibertekinsulation.com.

3. Guardian Fiberglass, Greer, SC www.guardianbp.com.
4. Johns Manville, Denver, CO www.jm.com.
5. Knauf Fiber Glass, Shelbyville, IN www.knaufusa.com.
6. Owens-Corning Fiberglass Corporation, Toledo, OH www.owens-corning.com.
7. Thermafiber, Wabash, IL www.thermafiber.com.

## 2.02 FOAM BOARD INSULATION MATERIALS

A. Type 2 Insulation:
   1. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
      a. Type and Compressive Resistance: Type X, 15 psi (104 kPa), minimum.
      b. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
      c. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

B. Type 1 & Type 3 Insulation:
   1. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
      a. Classifications:
         1) Type I: Faced with aluminum foil on both major surfaces of the core foam.
            (a) Class 2 - Glass fiber reinforced or non-reinforced core foam.
      b. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
      c. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
      d. Board Edges: Square.
      e. Products:
         1) (Type 3 Insulation) Dow Chemical Company; THERMAX (ci): www.dowbuildingsolutions.com/#sle.
            (a) Provide Weathermate flashing tape at all joints by Dow Chemical.
         2) (Type 3 Insulation) Dow Chemical Company THERMAX Heavy Duty: www.dowbuildingsolutions.com/#sle.

## 2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Order insulation by 'R' value rather than 'U' value, rating, or thickness, either 16 or 24 inches wide according to framing spacing.

B. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
   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. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Thermal Resistance: R-value in accordance with the following:
      a. Acoustically Insulated Ceilings:
         1) Enclosed Spaces: Fill framed cavity with batt of appropriate thickness.
         2) Unenclosed Spaces: R-19.
         3) Unenclosed Spaces above Offices and Restrooms: R-30.
      b. Thermally Insulated Ceilings / Roof:
         1) R-38C Cathedral / High Density: At 2x12 (50x300 mm) Overbuild Framing.

2) R-38 Standard: All Other. (R-49 in Climate Zones 6, 7, and 8).

c. Wood Wall Stud Framing:

1) (R-19) 5-1/2 inches deep

d. Framed Speaker Enclosures: R-11.

5. Kraft faced meeting requirements of ASTM C665, Type II, Class C.
6. Foil faced meeting requirements of ASTM C665, Type III.
   a. Class A: Exposed insulation.
   b. Class B: Enclosed insulation.
7. Unfaced Insulation: Meet requirements of ASTM C665, Type I.
8. Support at trussed rafters:
   a. Provide support at trussed rafters where insulation is not enclosed by structure or drywall.
   b. Provide stings/wires which run perpendicular to framing and attach at each trussed rafter and to framing at 32 inches O.C. minimum and where batt ends adjoin each other.
   c. Class Two Quality Standard: Simpson Strong Tie IS Insulation Supports with 14 gauge carbon steel, spring wire and mitered tips for 16 inch O.C. and 24 inch O.C. spacing.

## 2.04 BLOWN INSULATION

A. Blown Insulation: Fiber glass. Comply with requirements of ASTM C764, Type I or II, non-combustible when tested in accordance with ASTM E136.

B. 'R' Factor Required:
   1. Order insulation by 'R' factor rather than 'U' factor, rating, or thickness.
      a. Unenclosed Spaces: R38 minimum.

## 2.05 ACCESSORIES

A. Sheet Vapor Retarder: See Section 07 2600.

B. Attic Baffles:
   1. Design Criteria:
      a. Baffle can be used with spray foam, loose-fill, fiberglass, or other insulation materials.
   2. Acceptable Manufacturers:
      a. SB24 SmartBaffle by DCI Products, Inc., Clifton Heights, PA www.dciproducts.com.
      b. Equal as approved by Architect before bidding. See Section 01 6000.

C. Spindle-Type Anchors:
   1. Description:
      a. Spindle welded to plate and including self-locking washer.
      b. Perforated, galvanized carbon-steel plate 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square plate with copper-coated, low carbon steel, fully annealed, 0.105 inch (2.67 mm) diameter spindle, length to suit depth of insulation.
   2. Acceptable Products:
      a. Series T TACTOO Insul-hangers, RC150 or SC150 washers, and TACTOO Adhesive by AGM Industries, Brockton, MA www.agmind.com.
      b. Stic-Klip Type N Fasteners and Stic-Klip Type S Adhesive by Eckel Industries of Canada Ltd, Morrisburg, ON www.eckel.ca.
      c. Spindle Anchor, Dome-cap, R-150, or S-150 washer, Clutch-clip, and Tuff Bond Hanger Adhesive by GEMCO, Danville, IL www.gemcoinsulation.com.

## 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. Verification Of Conditions:
   1. Inspection:
      a. Examine substrate and verify framing is suitable for installation of insulation:
      b. Verify that mechanical and electrical services have been installed and tested.
      c. Notify Architect of unsuitable conditions in writing.
      d. Do not install insulation over unsuitable conditions:
         1) Commencement of Work by installer is considered acceptance of substrate.

### 3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Remove ties and concrete protrusions that would keep insulation from fully contacting foundation wall face.

B. Install against interior side of perimeter foundation walls extending downward from top of slab 48 inches or to top of footing, whichever is less. Install using 3/8 inch beads of adhesive at 12 inches on center vertically and at each vertical and horizontal joint to completely seal insulation.

C. Install horizontally for 48 inches under building slab continuously around building perimeter and between slab and foundation wall for full depth of slab.

### 3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Type 3 Insulation:
   1. Attachment to CMU wall.
      a. Attach insulation board to interior face of CMU wall as per manufacturer’s installation instructions to provide continuous insulation over entire surface at locations shown on Construction Documents on Z furring with mechanical fasteners and closure strips.
   2. Following Manufacturer Installation Instructions including the following:
      a. Butt adjoining boards tightly together with all seams vertical.
      b. Tape seams with Manufacturer’s white foil tape to cover joints and seams between boards of insulation. Match tape color to board color.
      c. Notch around wall members and other obstructions as closely as possible and seal with sealant.

B. Rigid thermal insulation board is not a structural panel and may not be used as nailing base for other building products.

### 3.04 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. If two layers of insulation are used to attain required 'R' value, only layer towards interior of building shall have facing.

C. Provide minimum clearance around recessed lighting fixtures as approved by local code.

D. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

E. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

F. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

G. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

H. Staple or nail facing flanges in place at maximum 6 inches on center.

I. Retain insulation batts in place with spindle fasteners at 12 inches on center.

J. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

K. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over face of member.

L. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member

M. Tape seal tears or cuts in vapor retarder.

N. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

O. Coordinate work of this section with requirements for vapor retarder, see Section 07 2600.

P. Coordinate work of this section with construction of air barrier seal, see Section 07 2700.

Q. Where insulation is not enclosed by structure or drywall, support in place with wire or other suitable material as approved by Architect before bid.

R. Attic Baffles:
   1. Install in accordance with manufacturer's instructions.
   2. Install baffles between trusses or rafters and underside of roof sheathing as shown on Contract Drawings.
   3. Install baffles between trusses and rafters at ventilation spaces to prevent insulation from blocking airflow from soffit.
   4. Install baffles to prevent insulation from blocking ventilation airflow from soffit.

S. Surface-Applied, Exposed on Masonry Walls:
   1. Install adhesively applied spindle-type anchors at 12 inches (305 mm) each way.
   2. After adhesive has dried, install insulation using foil-faced insulation only. Do not compress insulation below specified thickness and secure with specified washers.
   3. Apply capped washers to tips of spindles.

## 3.05 BLOWN INSULATION INSTALLATION

A. General:
   1. Install in accordance with manufacturer's instructions.
   2. Install in insulation in sufficient depth to provide thermal value specified after settlement of insulation.
   3. Do not blow insulation into electrical devices and vents.
   4. Provide minimum clearance around recessed lighting fixtures as approved by local code.

## 3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Field Tests And Inspections:
   1. Upon completion of installation, visually inspect each insulated area and verify that all insulation is complete and properly installed.

C. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:

1. Correct any work found not complying with contract document requirements at no additional cost to the Owner.

**3.07 PROTECTION**

A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

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**SECTION 07 2400**
**EXTERIOR INSULATION AND FINISH SYSTEMS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Composite wall and soffit cladding of rigid insulation and reinforced finish coating, Class PB.

B. Composite wall and soffit cladding of rigid insulation and reinforced finish coating over cementitious base coat, Class PM.

C. Drainage and water-resistive barriers behind insulation board.

D. Incidental uses of same finish coating applied directly to concrete and masonry.

### 1.02 REFERENCE STANDARDS

A. ANSI/FM 4880 - Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials 2017.

B. ASTM C150/C150M - Standard Specification for Portland Cement 2022.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2022.

D. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster 2022.

E. ASTM C1382 - Standard Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints 2016.

F. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage 2013 (Reapproved 2019).

G. ASTM E2570/E2570M - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage 2007 (Reapproved 2019).

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

I. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies 2018.

J. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS) 2022.

K. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing 2015.

L. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems 2009, with Editorial Revision (2014).

M. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies 2009, with Editorial Revision (2012).

N. ISO 9001 - Quality Management Systems — Requirements 2015.

### 1.03 SUBMITTALS

A. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

B. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.

1. Provide Manufacturer's details and recommended sealant application and details for flashing of drainage EIFS assembly.
2. Show wall layout, connections, details, expansion joints and installation sequence.

C. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

D. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.

E. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.

F. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Operations and Maintenance Data:
      1) Maintenance, cleaning, and repair instructions.
   b. Warranty Documentation:
      1) Final, executed copy of Warranty.
   c. Record Documentation:
      1) Manufacturers documentation:
         (a) Manufacturer's literature.
         (b) Color selection.
         (c) Shop Drawings.

## 1.04 QUALITY ASSURANCE

A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.

B. EIFS Manufacturer Qualifications: Provide EIFS products other than insulation from the same manufacturer with qualifications as follows:
1. Member in good standing of EIMA (EIFS Industry Members Association).
2. Manufacturer of EIFS products for not less than 5 years.
3. Manufacturing facilities ISO 9001 certified.

C. Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.

D. Installer shall be experienced and competent in installation EIFS systems and have performed at least ten (10) installations of similar size, scope, and complexity in each of the past five (5) years and be approved and listed applicator by EIFS Manufacturer.

E. Single Source Responsibility: All EIFS materials shall be from a single manufacturing source, or listed as an approved source.

F. Pre-Installation Conferences:
1. Participate in MANDATORY pre-installation conference.
2. Schedule meeting for after installation of foam and reinforcing mesh, but before flashing of openings.
3. In addition to agenda items specified in Section 01 3100, review following:
   a. During Conference, apply flashing at one window and associated back-wrapping at same location. Examine foam and reinforcing installation as well.

## 1.05 MOCK-UPS

A. Construct mock-up of typical EIFS application on specified substrate, size as required to include examples of all key conditions, and including flashings, joints, and edge conditions.

B. Field created sample of each color and texture to be used. Make sample with same tools and techniques to be used on Project.
   1. Acceptable sample panel to be standalone panel and not part of Work.
   2. Sample to be comprised of all wall assembly components including substrate, insulation board, Base Coat, Reinforcing Mesh, primer (if specified), Finish Coat, and typical sealant/flashing conditions.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

B. Storage: Store materials as directed by manufacturer's written instructions.
   1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F and temperatures in excess of 90 degrees F.
   2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
   3. Protect insulation materials from exposure to sunlight.
   4. Stack insulation board flat, fully supported off the ground.

### 1.07 FIELD CONDITIONS

A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.

B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.

D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

### 1.08 WARRANTY

A. Provide manufacturer's standard material warranty, covering a period of not less than 10 years.

B. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 5 years.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Quality Standard. See Section 01 6000.
   1. BASF Senergy Senerflex Channeled Adhesive Design.
   2. Dryvit Outsulation Plus MD.
   3. Parex Standard Water Master Drainage.
   4. Master Wall Rollershield Drainage System.

B. Approved Manufacturers:
   1. BASF Wall Systems, Jacksonville, FL www.senergy.basf.com.
   2. Dryvit, West Warwick, RI www.dryvit.com.
   3. Master Wall Inc, Midland, GA www.masterwall.com.
   4. Parex, Anaheim, CA www.parex.com.
   5. STO Finish Systems Div, Atlanta, GA www.stocorp.com.

### 2.02 EXTERIOR INSULATION AND FINISH SYSTEM

A. Description:
   1. Drainage type Exterior Insulation and Finish System (EIFS) consisting of Adhesive to create drainage planes, Expanded Polystyrene Insulation (EPS) Board, Base Coat with embedded Reinforcing Fabric Mesh, and Finish Coat. System is installed over drainage track or back wrapped weep holes and applied over glass mat gypsum sheathing or wall sheathing.
   2. Style / pattern / color as selected by Architect or Owner's Representative.

B. Design Criteria:
   1. EIFS shall be constructed such that it meets performance characteristics required in ASTM E2568.
   2. System to meet the performance and testing requirements of the International Code Council (ICC) Acceptance Criteria ICC-ES AC212 and ICC-ES AC235.
   3. Design Wind loads:
      a. Withstand positive and negative wind loads as specified by Building Code and tested by ASTM E330/E330M.
   4. Drainage Medium to comply with requirements of ASTM E2273.
   5. Substrate Systems:
      a. Engineered to withstand applicable design loads as required by IBC Chapter 16 including required safety factor.
      b. Maximum deflection of substrate system under positive or negative design loads shall not exceed L/240 of span except as otherwise approved in writing by EIFS manufacturer prior to installation.
      c. Substrate dimensional tolerance: Flat within 1/4 inch (6.4 mm) in any 4 feet (1.2 m) radius.
      d. Surface irregularities: Sheathing not over 1/8 inch (3 mm); masonry not over 3/16 inch (4.76 mm).
   6. Impact Resistance Classification: EIFS shall be classified in accordance with ASTM E2486/E2486M classification and impact ranges as follows:
      a. Standard Impact Resistance:
         1) Impact Range: 25-49 in-lbs (2.8 - 5.6 J).
         2) Minimum Tensile Strength: 150 lbs/in (27 g/cm).
   7. Insulation Board: Meet requirements of ASTM C578, nominal 1 lb per cu ft (16 kg per cu m) aged expanded polystyrene by EIFS Manufacturer.
   8. Portland Cement: Shall be Type I or II, meeting ASTM C150/C150M, white or gray in color, fresh and free of lumps.
   9. Weather Resistance:
      a. EIFS with drainage shall have an average minimum drainage efficiency of ninety (90) percent when tested in accordance of requirements of ASTM E2273.
      b. Water-resistive barrier shall comply with IBC Section 1404.2 or ASTM E2570/E2570M.

## 2.03 MATERIALS

A. General:
   1. Acceptable substrate:
      a. Gypsum Sheathing: See Section 06 1643: 'Gypsum Sheathing'.
      b. Oriented Strand Board (OSB): See Section 06 1636: 'Wood Panel Product Sheathing'.
      c. Plywood: See Section 06 1636: 'Wood Panel Product Sheathing'.

2. The configuration of the water resistive barrier, drainage plane and flashing and EIFS materials, must allow for the egress of incidental moisture.
3. Inclined surfaces shall follow the guidelines listed below:
    a. Minimum slope: 6 inch (152 mm) of vertical rise in 12 inches (305 mm) of horizontal run.
    b. For sloped surfaces, run of slope shall be a maximum of 12 inches (305 mm).
    c. Usage not meeting above criteria shall be approved by EIFS Manufacturer prior to installation.
4. Building interior shall be separated from insulation board by 1/2 inch (12.7 mm) of gypsum board or equivalent fifteen (15) minute thermal barrier.

B. Base Coat:
1. Manufacturer's standard.

C. Drainage Track:
1. Standard of EIFS Manufacturer.

D. Finish Coat:
1. One hundred (100) percent acrylic, factory-mixed, elastomeric, flexible coating with integral color and texture.

E. Liquid Applied Water Resistive Barrier:
1. Apply liquid applied water resistive barrier over all seams of sheathing and embed sheathing tape.
2. Then spray or roll apply additional liquid applied water resistive barrier over all sheathings and substrates in number of coats and constancy as per Manufacturer’s requirements and recommendations to achieve coverages as required.

F. Insulation Board:
1. At system termination, completely encapsulate insulation board edges by mesh reinforced base coat, substrate or drainage track (limited to terminations at foundation).
2. Maximum thickness of insulation board shall be in accordance with applicable building codes and EIFS manufacturer requirements.

G. Insulation Board Adhesive: Standard of EIFS Manufacturer.

## 2.04 ACCESSORIES

A. Flashing:
1. Flashing shall be continuous and watertight.
2. Flashing shall be designed and installed to prevent water infiltration behind the EIFS.

B. Expansion Joints: Continuous expansion joints shall be installed at the following locations in accordance with Manufacturer’s recommendations:
1. At building expansion joints.
2. At substrate expansion joints.
3. At floor lines in wood frame construction.
4. Where EIFS panels abut one another.
5. Where EIFS abuts other materials.
6. Where significant structural movement occurs, such as the following:
    a. Changes in roof line.
    b. Changes in building shape and/or structural system.
    c. Where substrate changes.

7. Substrate movement and expansion and contraction of EIFS and adjacent materials shall be taken into account in design of expansion joints, with proper consideration given to sealant properties, installation conditions, temperature range, coefficients of expansion of materials, joint width to depth ratios, and other material factors. Minimum width of expansion joints shall be as follows:
    a. 1/2 inch (12.7 mm) where EIFS abuts other materials.
    b. 3/4 inch (19 mm) EIFS abuts the EIFS.

C. Mechanical Fasteners:
1. Masonry:
    a. Type M expansion fastener with 1-1/2 inch (38 mm) diameter washer and one inch (25 mm) minimum penetration into masonry.
2. Steel Framing, 20 ga (0.91 mm) And Thinner:
    a. Type S self-tapping bugle head screws with 1-1/2 inch (38 mm) diameter washer and 5/8 inch (15.9 mm) minimum penetration into framing.
3. Wood Framing:
    a. Type W bugle head screws with 1-1/2 inch (38 mm) diameter washer and 5/8 inch (15.9 mm) minimum penetration into framing.

D. Reinforcing Mesh:
1. Standard Mesh: Balanced, open weave treated glass fiber mesh by EIFS Manufacturer, 4 oz per sq yd (135 g per sq m) minimum weight.
2. High Strength Mesh: A balanced, open weave treated glass fiber mesh by EIFS Manufacturer made for high impact areas, 20 oz per sq yd (678 g per sq m) minimum.

E. Sealants:
1. Quality Standard. See Section 01 6000:
    a. Silicone by Dow or GE as acceptable to EIFS Manufacturer.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

B. Verify that step flashing and roof diverters have been installed properly for 'roof to wall'

C. Notify Architect of unsuitable conditions in writing.
1. Do not install material over unsuitable conditions.

D. Commencement of Work by installer is considered acceptance of substrate.

### 3.02 PREPARATION

A. Install self-furring metal lath over solid substrates that are deemed unacceptable to receive adhesively applied insulation. Install in accordance with ASTM C1063, except for butt-lapping instead of overlapping.

B. Protect adjoining work and property during installation.

C. Clean surfaces thoroughly prior to installation.

D. Prepare substrate to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion using methods recommended by the Manufacturer for achieving best results.

E. Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.

**3.03 INSTALLATION - GENERAL**

A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.
   1. Where different requirements appear in either document, comply with the most stringent.
   2. Neither of these documents supersedes provisions of Contract Documents that defines contractual relationships between parties or scope of this work.

B. Roof To Wall:
   1. Provide 2 inch (50 mm) minimum spacing above roofing.

C. Liquid Applied Water Resistive Barrier:
   1. Verify substrate is dry, clean, sound, and free of releasing agents, paint, or other coatings prior to installation of fluid applied water resistive barrier.
   2. Apply reinforcing mesh to all existing holes, seams and chipped areas.
   3. Once first coat of holes, seams and chipped areas are covered with reinforcing mesh and fluid applied water resistive barrier is applied, apply new coat over entire existing sheathing surface.

D. Insulation Board:
   1. Follow Manufacturer’s written instruction for installation of Insulation Board.
   2. Apply insulation board horizontally in running bond pattern with joints staggered in relation to substrate joints and staggered and interlocked at corners.
   3. Attach board to substrate with mechanical fasteners where required by EIFS Manufacturer.
   4. Sand high spots to create smooth surface.

E. Base Coat And Reinforcing:
   1. Apply base coat to insulation board on fascia, soffit, and wall areas below level of lower eaves.

F. Embed one (1) layer of high strength mesh with edges abutted and material smoothed out until completely embedded in adhesive. Allow twenty-four (24) hours to cure.
   1. Apply base coat over cured, reinforced base coat and remaining exposed insulation board.

G. Embed one (1) layer of standard reinforcing mesh overlapping edges 2-1/2 inches (63 mm) minimum. Smooth out material until completely embedded and allow to cure for twenty-four (24) hours.
   1. Apply base coat to all exposed insulation board. Embed one (1) layer of high strength mesh with edges abutted and material smoothed out until completely embedded in adhesive. Allow to cure for twenty-four (24) hours.
   2. Apply base coat over cured, reinforced base coat. Embed one (1) layer of standard reinforcing mesh overlapping edges 2-1/2 inches (63 mm) minimum. Smooth out material until completely embedded and allow twenty-four (24) hours to cure.

H. Finish Coat:
   1. Correct surface irregularities, such as trowel marks and board lines.
   2. Apply finish coat with stainless steel trowel using sufficient manpower and equipment to insure continuous wet edge to prevent cold joint, scaffolding lines, etc. Same type of equipment and techniques shall be used by all applicators. Finish shall closely match samples prepared for Architect.

I. Apply sealants as required by EIFS Manufacturer.

### 3.04 TOLERANCES

A. Deflection of the substrate systems shall not exceed L/240 times the span.

B. Substrate shall be flat within 1/4 inch (6.4 mm) in 4 feet (1.2 m) radius.

### 3.05 FIELD QUALITY CONTROL

A. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Roof To Wall:
      a. Non-conforming work includes required 2 inch (50 mm) minimum spacing above roofing.
   2. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

### 3.06 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

### 3.07 PROTECTION

A. Protect completed work from damage and soiling by subsequent work.

**END OF SECTION**

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**SECTION 07 2500**
**WEATHER BARRIERS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

### 1.02 SUBMITTALS

A. Product Data: Provide data on material characteristics and performance criteria.

B. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

### 1.03 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

## PART 2 PRODUCTS

### 2.01 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:
   1. Approved Products. See Section 01 6000:
      a. Styrofoam Weathermate Plus by Dow, Chemical Co, Midland, MI www.dow.com
      b. Tyvek HomeWrap by Du Pont Company, Wilmington, DE www.dupont.com
      c. DriShield Housewrap by Protecto Wrap, Denver, CO www.protectowrap.com
      d. Fortress Pro by Raven Industries, Sioux Falls, SD www.ravenind.com
      e. Typar Housewrap by Fiberweb, Old Hickory, TN www.typar.com.
   2. Materials:
      a. Air Retarder:
         1) Non-woven.
         2) Meet requirements of ASTM E1677, Type I.
      b. Sealing Tape:
         1) Acceptable Products:
            (a) DuPont Contractor Tape.
            (b) Fortress Pro Seaming Tape.
            (c) Typar Construction Tape.
            (d) 3M Contractor Sheathing Tape.
            (e) Protecto Wrap BT25 XL Window Sealing Tape.
            (f) As recommended in writing by Air Retarder Manufacturer.
      c. Fasteners:
         1) Approved Products.
            (a) Metal Framing: Corrosion resistant, self-tapping screws and plastic washers or Tyvek Wrap Caps. Screws to be 3/4 inch (19 mm) long minimum and washers one inch (25 mm) diameter.
            (b) Wood Framing: Corrosion resistant roofing nails with 3/4 inch (19 mm) long shank minimum and one inch (25 mm) diameter plastic head or Tyvek Wrap Caps. Staples are only allowed to aid in installation with permanent fasteners installed immediately thereafter.

### 2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.

## 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 installation instructions.

### 3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

C. Mechanically Fastened Exterior Sheets:
   1. Install sheets shingle-fashion to shed water, with seams aligned horizontal.
   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. Attach to masonry construction using mechanical fasteners spaced at 12 to 18 inches vertically on center, and at 24 inches, maximum, horizontally on center.
   6. 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.
   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. Mechanically Fastened Sheets - Vapor Retarder On Interior:
   1. When insulation is to be installed in assembly, install vapor retarder over insulation.
   2. Installation as Air Barrier System:
      a. Roof/Attic/Ceiling Applications:
         1) Staple to bottom of ceiling joists as recommended by Manufacturer.
         2) Seal retarder to interior and exterior wall top plates using recommended sealants.
         3) Fasten retarder through sealant to plates as recommended by Manufacturer.
         4) Allow retarder to overlap at corners as recommended by Manufacturer.
      b. Exterior Wall Applications:
         1) Install wall application as recommended by Manufacturer.
         2) Apply recommended sealant over ceiling overlapped retarder material at top plate, to frame around window and door rough openings and to bottom plate as recommended by Manufacturer to ensure an air-tight assembly.
      c. Acoustical and Sealant Application at Sheet Terminations:
         1) Install sealants as recommended by Manufacturer to ensure an air-tight assembly.
      d. Lapped Joint Treatment:

1) Apply recommended sealant to wood stud surface.
2) Overlap and as recommended by Manufacturer.
3) Seal overlapped joint using recommended sheathing tape.
4) All vertical and horizontal seams should be treated as described above.

e. Penetrations:
1) Building envelope penetrations include windows, doors, electrical outlets, gas lines, plumbing, etc:
(a) Cut and fit sheeting tightly around penetrations as recommended by Manufacturer.
(b) Seal retarder around all electrical, HVAC and plumbing penetrations with recommended sealants or sheathing tapes.

f. Window and Door Treatment:
1) Cut sheeting to fit rough opening as recommended by Manufacturer.
2) Apply recommended sealant between retarder and window frame.
3) Attach through sealant to window head, jambs and sill. Seal window to rough opening with recommended sealant.
4) Apply recommended sealant between interior finishing material and attached sheeting.

g. Sheet Tears and Holes:
1) Cover all tears and holes with recommended sheathing tape.
2) Treat large holes (greater than 1 inch (25 mm)) like large penetrations using square patch.

h. Electrical Outlets:
1) Wrap and seal electrical boxes using recommended sheathing tapes and sealants.
2) Airtight plastic boxes are recommended.

i. Plumbing Penetrations:
1) Secure plumbing lines to rigid mounting panel.
2) Seal penetrations using recommended sealants.
3) Attach sheeting to mounting panel using recommended sealants.

j. Air Barrier System Continuity:
1) Install as continuous interior air barrier system:
(a) Maintain air barrier system continuity at wall, ceiling, floor and foundation intersections. Use recommended sealants. Seal between framing and retarder overlaps.
(b) Coordinate installation details with framing and insulation trade contractors.

3. Fasteners:
a. Fasteners as approved by Manufacturer:
1) Following recommendations for type, size, spacing and installation methods.
2) To resist wind forces, fastened to supporting structure and supported by gypsum wallboard on one side and insulation on other.

4. Seal penetrations through vapor retarder immediately before installation of gypsum board.

E. Openings and Penetrations in Exterior Water-Resistive 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 FIELD QUALITY CONTROL

A. Owner's Inspection and Testing: Cooperate with Owner's testing agency.
   1. Allow access to work areas and staging.
   2. Notify Owner's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
   3. Do not cover work of this section until testing and inspection is accepted.

B. Vapor retarder is to be airtight and free from holes, tears, and punctures.
   1. Immediately before installation of gypsum board, inspect vapor retarder for holes, tears, and punctures and repair damaged areas.
   2. Immediately before completion of Project, inspect exposed vapor retarder for holes, tears, and punctures and repair damaged areas.

C. Do not cover installed water-resistive barriers until required inspections have been completed.

D. Obtain approval of installation procedures from water-resistive barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

E. Take digital photographs of each portion of installation prior to covering up weather barriers.

## 3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION**

**SECTION 07 3113**
**ASPHALT SHINGLES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Asphalt shingle roofing.

B. Flexible sheet membranes for eave protection, underlayment, and valley protection.

C. Metal flashing.

### 1.02 DEFINITIONS

A. Flame Spread Classification: Categories as per ASTM E84/UL 723 or CAN/ULC-S102:
   1. Class A: Highest fire-resistance rating for roofing as per ASTM E108. Indicated roofing is able to withstand severe exposure to fire exposure to fire originating from sources outside building.
   2. Class B: Fire-resistance rating indicating roofing materials are able to withstand moderate exposure to fire originating from sources outside of building.
   3. Class C: Fire-resistance rating indicating roofing materials are able to withstand light exposure to fire originating from sources outside of building.

B. Wind Speed (IBC):
   1. Hurricane-Prone Regions: Areas vulnerable to hurricanes defined as:
      a. U.S. Atlantic Ocean and Gulf of Mexico coasts and Hawaii where basic wind speed is greater than 90 mph.
   2. Wind-Borne Debris Region: Portions of hurricane-prone regions that are within 1 mile of coastal mean high-water line where basic wind speed is 110 mph or greater, or Hawaii.

C. Wind Uplift: Wind-induced forces on roof system or components in roof system. Wind uplift generally includes negative pressure component caused by wind being deflected around and across surfaces of building and positive pressure component from air flow beneath roof deck.

### 1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

D. ASTM D3019/D3019M - Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered; 2017.

E. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020.

F. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules; 2019.

G. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2021).

H. ASTM D7158/D7158M - Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method); 2020.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

J. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.

K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL (DIR) - Online Certifications Directory; Current Edition.

M. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

N. UL 2218 - Standard for Impact Resistance of Prepared Roof Covering Materials; Current Edition, Including All Revisions.

O. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

Q. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating material characteristics, performance criteria, limitations.

C. Shop Drawings: For metal flashings, indicate specially configured metal flashings, jointing methods and locations, fastening methods and locations, installation details.

D. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color selection.

E. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Certificates:
   1. Installers:
      a. Provide current Certification for completion of certified training from Shingle Manufacturer.
      b. Installer's signed certificate stating roofing system complies with Contract Documents performance requirements and work only performed by trained and authorized personnel in those procedures.

H. Tests And Evaluation Reports:
   1. Manufacturer's test reports.
   2. Wind speed coverage for warranted wind speed.
   3. High wind reports and approvals if required by AHJ.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Special Procedure Submittals:
   1. Contact Owner’s Representative (FM Group or Project Manager) for following information:
      a. Installer to include following mandatory information to be added to ‘Roofing Manufacturer System Warranty’ submitted with Closing Documents.

1) Name of Owner (name of FM Group)
_____
2) Mailing Address (FM office address)
_____
3) Building Property ID (unique 7 digit identifier)
_____
4) Project site address:
_____
5) Roof Completion Date
_____
6) Any addition data required from Manufacturer.

b. Installer to include following mandatory information to be added to 'Roof Installer Workmanship Warranty' submitted with Closing Documents:
1) Name of Owner (name of FM Group)
_____
2) Mailing Address (FM office address)
_____
3) Building Property ID (unique 7 digit identifier)
_____
4) Project site address:
_____
5) Roof Completion Date
_____
6) Any addition data required from Manufacturer.

K. Qualification Statement:
1. Installer:
a. Asphalt Shingles:
1) Provide Qualification documentation.

L. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Warranty Documentation:
1) Asphalt Shingles:
(a) Final, executed copy of 'Roofing Manufacturer System Warranty' including wind speed coverage and required Owner mandatory information.
(b) Final, executed copy of 'Roof Installer Workmanship Warranty' including required Owner mandatory information.
2) Verify mandatory information as specified in Special Procedure Submittal has been included in Final Warranty.
b. Record Documentation:
1) Manufacturers Documentation:
(a) Manufacturer's literature.
(b) Color selections.
(c) Test and evaluation reports.
2) Roofing Inspection Documentation:
(a) Include copy of roof inspection report.
3) Certificate: Installer statement of compliance for performance requirements.
4) Certificate: Installer completion of certified training.

5) Test And Evaluation Report: UL fire-resistance rating test report.
6) Test And Evaluation Report: NFPA 101 Class A approval.
7) Test And Evaluation Report: Wind resistance requirements required.

M. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements for additional provisions.
2. Extra Shingles: 100 sq ft; (1) Square minimum of each type and color of bundled shingles.

## 1.05 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer:
a. Asphalt Shingles:
1) Asphalt shingles are required to be produced under quality control program administered by inspection agency currently accredited by ICBO ES or recognized by National Evaluation Service, Inc. Quality control manual developed in consultation with approved agency, and complying with ICBO ES Acceptance Criteria for Quality Control Manuals (AC10), must be submitted.
b. Underlayment:
1) Underlayment is required to be manufactured under approved quality control program with inspections by inspection agency accredited by International Accreditation Service (IAS) or otherwise acceptable to ICC-ES.
2) Quality documentation complying with ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted for roof underlayment.
2. Roof Installer Foreman Qualifications:
a. Requirements of Section 01 4301 applies but not limited to the following:
1) Provide documentation if requested by Architect.
(a) Approved and authorized by Roofing Manufacturer to install Manufacturer’s product and eligible to receive Manufacturer’s warranty before bid.
(b) Completed Shingle Manufacturer’s certified trained.
(c) Have thorough knowledge of installing asphalt shingle roofing and have minimum of five (5) years roofing experience.
(d) Current license for the city, county, and state where project is located and license for specific type of roofing work to be performed.
(e) Roofing Installer’s foreman shall be skilled in his trade and qualified to lay out and supervise the Work.
(f) Flashing installation shall be performed by personnel trained and authorized by Roofing Manufacturer.
3. Roof Installer:
a. Provide 'Roof Installer Workmanship Warranty' as specified in Warranty in Part 1 of this specification.

B. Pre-Installation Conference:
1. Participate in MANDATORY pre-installation conference:
a. Roofing Installer’s Foreman and those responsible for installation of roofing to be in attendance. Include Shingle Manufacturer’s Representative if available.
2. Schedule pre-installation conference at project site after completion of the installation of roof sheathing but before installation of any roofing system component.
3. In addition to agenda items specified in Section 01 3100, review following:
a. Review if Project is in high wind area.

b. Review if Project could have ice dam problems.
c. Review if Project could have fungus-algae resistance problems.
d. Review Shingle Manufacturer’s ventilation requirements.
e. Review Shingle Manufacturer’s Ambient Conditions requirements.
f. Review existing roof conditions including moisture on deck, protruding deck fasteners, specified gaps between sheathing, and other items affecting issuance of roofing warranty.
g. Review proper valley, flashing, penetrations, secondary underlayment, sealants, and nailing requirements.
h. Review racking installation method is not permitted.
i. Review steeple base secondary underlayment installation under Steeple.
j. Review Cleaning and Disposal requirements.
k. Review Special Procedure Submittal for Warranty Information to be given to Manufacturer before Manufacture will issue Roof Warranty by Installer.
l. Review safety issues.

C. Sequencing:
1. Sequence of Roofing Materials (see valley flashing detail in Contract Drawings):
a. Apply continuous 12 inches (300 mm) wide strip at edge of eaves and rakes of secondary underlayment.
b. Metal drip edge.
c. Secondary underlayment.
d. Apply three (3) continuous 36 inch (900 mm) wide sheets of secondary underlayment in valley.
e. Install one (1) continuous 36 inch (300 mm) wide strip of primary underlayment atop secondary underlayment and centered over valley.
f. Install formed valley metal over strip of primary underlayment.
g. Apply 12 inches (300 mm) wide strips of secondary underlayment lapping nailed edge of formed valley metal 3 inches (75 mm).
h. Primary underlayment.
i. Asphalt shingles.
j. Counter flashings over step flashing.
2. Coordinate sequencing of products furnished in Section 07 7100: 'Roof Specialties'.

## 1.06 FIELD CONDITIONS

A. Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.

B. Do not install shingles, eave protection membrane, underlayment, or when surface, ambient air, wind chill, or temperatures are below 45 degrees F.

C. Shingles:
1. Do not install shingles at lower temperatures than allowed by Shingle Manufacturer for application.

D. Underlayment:
1. Install self-adhering sheet underlayment within range of ambient and substrate temperatures recommended by manufacturer.

## 1.07 WARRANTY

A. Special Warranty:

1. Shingle Manufacturer's special forty (40) year minimum labor and material warranty written for The Church of Jesus Christ of Latter-day Saints program, including but not limited to:
    a. CertainTeed:
        1) First ten (10) years minimum of warranty will provide for full replacement cost, including tear-off and disposal, for any failure, including material defects and workmanship.
        2) Remaining thirty (30) years of warranty will provide for pro-rated replacement cost.
    b. GAF:
        1) First ten (10) years minimum of warranty will provide for full replacement cost, including tear-off and disposal, for any failure, including material defects and workmanship.
        2) Remaining thirty (30) years of warranty will provide for pro-rated replacement cost.
    c. Owens Corning:
        1) First ten (10) years minimum of warranty will provide for full replacement cost, including tear-off and disposal, for any failure, including material defects and workmanship.
        2) Remaining thirty (30) years of warranty will provide for pro-rated replacement cost.
2. Standard Wind Areas:
    a. Roofing system will resist blow-offs in winds up to 110 mph (177 kph) for ten (10) years when installed as specified below.
    b. Meet requirements of ASTM D3161/D3161M UL Class D.
3. High Wind Areas:
    a. Roofing system will resist blow-offs in winds between 110 mph (177 kph) and up to 130 mph (209 kph) for ten (10) years when installed as specified below.
        1) Meet requirements of ASTM D3161/D3161M UL Class F.
        2) Meet requirements of ASTM D7158/D7158M UL Class H.
        3) Shingle Manufacturer’s starter shingles are installed on all eve and rakes.
        4) Shingle Manufacturer’s hip and ridge shingles are installed where shown on Contract Documents.
        5) Shingle Manufacturer’s recommended nailing pattern is followed.
4. Algae resistance for fifteen (15) years.
5. Roof Installer Workmanship Warranty:
    a. Provide ten (10) year workmanship warranty on roofing system and related components, including flashings, and responsible for all repairs to roofing system and related components due to roof installer’s own negligence or faulty workmanship:
        1) In the event that, during ten (10) year period following installation, Roof Installer defaults or fails to fulfill its obligation in relation to workmanship warranty as specified in Manufacturer’s Agreement, Manufacturer will assume that obligation for remainder of ten (10) year period following original installation and Owner shall have no obligation to make or pay for repairs to or materials for roofing system that are necessary due to Roof Installer’s negligence or faulty installation during that period.
    b. Steeple:
        1) Square Tube Pipe Boot:
            (a) Manufacturer’s twenty (20) year warranty covering material.

## 1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Make no deliveries to job site until installation is about to commence, or until approved storage area is provided.
   2. Deliver products job site in Manufacturer's original unopened containers or wrappings with labels intact and legible bearing all seals and approvals.
   3. Deliver materials in sufficient quantities to allow continuity of work.
   4. Remove any material not approved from job site.

B. Storage And Handling Requirements:
   1. Storage Requirements:
      a. Follow Manufacturer’s instructions and precautions for storage and protection of materials.
      b. Protect roof materials from physical damage, moisture, soiling, and other sources in a clean, dry, protected location.
      c. Stacking:
         1) Shingles: Bundles should be stacked flat.
         2) Underlayment:
            (a) Do not double-stack pallets.
            (b) Stack rolls upright until installation.
      d. Temperature:
         1) Shingles:
            (a) Store in covered ventilated area at maximum temperature of 110 deg F (43 deg C).
            (b) Use extra care in handling shingles when temperature is below 40 deg F (4.4 deg C).
         2) Underlayment: Store in area with temperature between 40 deg F and 100 deg F (4.4 deg C and 38 deg C).
      e. Unacceptable Material:
         1) Remove from job site materials that are determined to be damaged by Architect or by Roofing Manufacturer and replace at no additional cost to Owner.
   2. Handling Requirements:
      a. Handle rolled goods to prevent damage to edge or ends.
   3. Roof Top Loading:
      a. Lay shingle bundles flat.
      b. Do not bend over ridge.

# PART 2 PRODUCTS

## 2.01 REGULATORY AGENCY SUSTAINABILITY APPROVALS

A. Building Codes:
   1. Meet requirements for NFPA 101 Class A roof assembly.
   2. Roof system will meet requirements of all federal, state, and local codes having jurisdiction.

B. Fall Protection: Meet requirement of fall protection as required by federal, state, and local codes having jurisdiction.

C. Fire Characteristics:

1. Provide shingles and related roofing materials with fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency:
    a. Exterior Fire-Test Exposure: Class A; UL 790, CAN/ULC-S102, or ASTM E108, for application and roof slopes indicated.
        1) Materials shall be identified with appropriate markings of applicable testing agency.

D. Impact Resistance:
    1. Meet UL 2218 impact resistant testing.
    2. Meet UL 2218 Class 4 impact resistant rating for hail.

E. Wind Resistance:
    1. Meet ASTM D3161/D3161M for wind resistance.
        a. Installation shall comply with IBC Table 1507.2.7, 'Attachment'.

F. Wind Speed:
    1. As required to meet local codes having jurisdiction.

G. Wind Uplift Resistance:
    1. Meet UL 580 wind uplift of roof assemblies.
    2. Meet UL 1897 uplift test for roof covering systems.
    3. Meet ASTM D7158/D7158M for wind resistance for uplift force/uplift resistance.

## 2.02 MANUFACTURERS

A. Manufacturer Contact List:
    1. CertainTeed Roofing Products, Valley Forge, PA www.certainteed.com.
        a. Contact Information: Wendy Fox, (800) 404-9880, wfox@dataworksintl.com.
    2. GAF Materials Corp., Wayne, NJ www.gaf.com.
        a. Contact Information: Dean Mathews (cell) (503) 410-1234, dean.mathews@gaf.com
    3. Owens Corning, Toledo, OH www.owenscorning.com.
        a. Duration Premium shingles are available in all areas of the USA and Canada including all Duration Premium colors under Church contract. Request shingles through local distribution. Any distribution questions, contact Area Sales Manager.
        b. For all other questions, Contact: Robert Hill (801) 244-0630 Robert.Hill@owenscorning.com.

## 2.03 APPROVED INSTALLERS

A. Contact manufacturers for a list of approved installers servicing the project area.
    1. CertainTeed:
    2. GAF:
    3. Owens-Corning:

## 2.04 ASPHALT SHINGLES

A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
    1. Fire Resistance: Class A, complying with ASTM E108.
    2. Wind Resistance: Tested in accordance with ASTM D3161/D3161M.
        a. Standard Wind Areas: ASTM D3161/D3161M UL Class D.
        b. High Wind Areas:

1) ASTM D3161/D3161M UL Class F.
2) ASTM D7158/D7158M UL Class H.

3. Impact Resistant Shingles: Meet requirements of UL 2218 Class 4 Impact, ASTM E108 Class A Fire Resistance, ASTM D3161/D3161M Class F Wind, ASTM D7158/D7158M Class H Wind, ASTM D3018/D3018M Type 1, ASTM D3462/D3462M, and UL 790 Class A Fire Resistance.
4. Secondary Underlayment: Meet requirements of ASTM D1970/D1970M and UL 790 Class A Fire Resistance.
5. Primary (Synthetic) Underlayment: Meet requirements of ASTM D226/D226M and ASTM D4869/D4869M (physical properties only) or ASTM D1970/D1970M and ASTM E108 Class A Fire.
6. Algae resistant.
   a. Use compatible flashing and trim materials to avoid electrolysis problem with material used in algae shingles.
7. Color: As selected by Architect. **WEATHERED WOOD.**
8. Approved Manufacturers and Products.
   a. CertainTeed:
      1) Shingles:
         (a) Standard Wind: Landmark PRO / Landmark Premium.
         (b) High Wind: Landmark PRO / Landmark Premium.
         (c) Impact Resistant: Landmark TL/NorthGate ClimateFlex
         (d) Hip And Ridge Shingles: Shadow Ridge Mountain Ridge/Shadow Ridge ClimateFlex (impact resistant)
      2) Primary Underlayment Under Shingles:
         (a) Synthetic Underlayment: DiamondDeck.
      3) Secondary Underlayment Under Shingles:
         (a) WinterGuard Granular.
         (b) WinterGuard Sand.
         (c) WinterGuard PRO (D) GRACE VYCOR series
      4) Secondary Underlayment Under Shingles over Unheated Buildings:
         (a) Not required over unheated buildings such as Storage Shed and Stake Pavilions.
   b. GAF:
      1) Shingles:
         (a) Standard / High Wind: Timberline HDZ.
         (b) Impact Resistant: Timberline ArmorShield II.
         (c) Hip And Ridge Shingles: TimberTex (East), TimberCrest (West), Seal-A-Ridge (West)
      2) Primary Underlayment Under Shingles:
         (a) Synthetic Underlayment: Tiger Paw.
         (b) Equal alternative: Deck Armor
      3) Secondary Underlayment Under Shingles:
         (a) Weatherwatch.
         (b) StormGuard.
      4) Secondary Underlayment Under Shingles over Unheated Buildings:
         (a) Not required over unheated buildings such as Storage Shed and Stake Pavilions.

c. Owens Corning:
1) Note:
(a) Duration Flex shingles are available in all areas of the USA and Canada including all Duration Flex colors under Church contract. Request shingles through local distribution.
(b) Any questions, contact Manufacturer's Area Sales Manager.
2) Shingles:
(a) Standard / High Wind: Duration Flex shingles.
(b) Impact Resistant: Duration Storm Impact-Resistant Shingles with WeatherGuard.
(c) Hip And Ridge Shingles: DecoRidge Hip & Ridge.
3) Primary Underlayment Under Shingles:
(a) Synthetic Underlayment: Deck Defense High Performance Roof Underlayment.
4) Secondary Underlayment Under Shingles:
(a) Weatherlock G Granulated Self-Sealing Ice & Water Barrier.
(b) Weatherlock Specialty Tile & Metal for High Temperature.
(c) Weatherlock Cold Climate for cold weather adhesion and flexibility.
5) Secondary Underlayment Under Shingles over Unheated Buildings:
(a) Not required over unheated buildings such as Storage Shed and Stake Pavilions.

## 2.05 SHEET MATERIALS

A. Elastomeric Roofing Sealant:
1. Design Criteria:
a. Meet requirements of ASTM D3019/D3019M.
b. Non-asphalt roofing cement (not permitted).
c. Elastomeric.
d. Cold temperature pliability.
e. Compatible with roof penetration boots.

B. Fasteners:
1. Primary Underlayment:
a. Corrosion resistant roofing nails with one inch (25 mm) diameter head and 3/4 inch (19 mm) long shank minimum.
1) If shingles applied as underlayment is laid, use metal or plastic head Simplex roofing nails.
2) If shingles not applied as underlayment is laid, use plastic head only.
b. Staples not permitted.
2. Shingles:
a. Design Criteria:
1) Meet following requirements for nails:
(a) Comply with ASTM F1667, Type I, Style 20-Roofing Nails.
(b) Eleven gauge galvanized steel or equivalent corrosion-resistant roofing nail.
(c) Nail head sizes: 3/8 inch (9.5 mm) nominal diameter.
(d) Sufficient length to penetrate through roof sheathing 1/4 inch (6 mm) or 3/4 inch (19 mm) minimum into solid wood decking.

(e) Hot-dipped galvanized or electroplated fasteners comply with requirements of ASTM A153/A153M, Class D.
(f) Stainless-steel fasteners meet requirements of Type 304 (UNS S30400) or Type 316 (UNS S31600).

b. General:
1) Hot-dipped galvanized, electroplated non-corrosive gun-driver nails, or stainless-steel fasteners may be used.
2) Fasteners within 15 miles (24.1 km) of coastal areas (oceanside) applications must use hot-dipped galvanized or stainless steel.
3) All exposed fasteners (including ridge shingles) must use hot-dipped galvanized or stainless steel.
4) Staples not permitted:
(a) Architect/Roof Consultant may approve in writing, staple gun that installs exposed fasteners with staples.

C. Steeple:
1. Square Tube Pipe Boot:
a. Description:
1) Square.
2) Temperature range: -65 deg F (-55 deg C) to +270 deg F (132 deg C).
b. Type:
1) Weather resistant.
2) Roof adaptability.
3) EPDM (Ethylene Propylene Diene Monomer).
4) Color: Black.
5) Sealing unit to roof shall be done in accordance with Pipe Boot Manufacturer's recommendations.
c. Acceptable Products:
1) Master Flash by Aztec Washer Company, Inc., Poway, CA www.aztecwasher.com.
(a) Model RF101BP-SQ.
2) Large Retrofit Flashing by Portals Plus, Bensenville, IL www.portalsplus.com.
(a) Model 11025 with 4 inches (100 mm) square Adapter.
(b) Provide necessary adapter rings including angle iron and square tube adapters.
(c) Hardware shall be stainless steel.
3) Equal as approved by Architect before installation. See Section 01 6200.

## 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. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.

B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or eave protection.

D. Install eave edge flashings tight with fascia boards, weather lap joints 2 inches and seal with roof cement, and secure flange with nails spaced __6__ inches on center.

E. Protection Of In-Place Conditions:
   1. Install only as much roofing as can be made weathertight each day, including flashing and detail work.

F. Surface Preparation:
   1. Clean roof deck:
      a. Remove dirt, protruding nails, shingle nails, and debris, before installation of underlayment.
   2. Roof deck must be dry to help prevent buckling of deck, which can result in deck movement and damage to primary underlayment.
   3. Following Manufacturer’s recommendations for placing materials on roof.
      a. Prevent material from sliding off roof.

**3.03 INSTALLATION - GENERAL**

A. General:
   1. Schedule and execute work without exposing interior building areas to effects of inclement weather. Protect existing building and its contents against all risks.

B. Sequence of Roofing Materials as shown and noted on Contract Drawings:
   1. 12 inch strip Secondary Underlayment at Eave.
   2. Metal Drip Edge.
   3. General Secondary Underlayment.
   4. Valley Secondary Underlayment (8' - 6" (2.62 m) wide strip of Secondary Underlayment (3 strips) in Valleys applied over sheathing).
   5. Valley Secondary Underlayment (36 inch (915 mm) wide Primary Underlayment under Valley Metal).
   6. Valley Metal (24 inch (610 mm) wide valley metal 10 ft (3.05 m) lengths). Number Project Date Project Name Asphalt Shingles - 19 - 07 3113 7. 12 inch strip of Secondary Underlayment over nailed edges (of Valley Metal).
   7. General Primary Underlayment.
   8. Asphalt Shingles, Step Flashings.
   9. Counter Flashing.

**3.04 INSTALLATION - UNDERLAYMENT**

A. General:
   1. Temporary Roof:
      a. Do not use permanent underlayment installation as temporary roof.
      b. If temporary roof is used, remove completely before installation of permanent underlayment.
   2. Follow Shingle Manufacturer's recommendations for installation of primary and secondary underlayment, particularly at eaves, rakes, low-slopes, and penetrations, unless specified installation procedures and Contract Drawing details are more stringent.

3. Avoid scuffing underlayment that can compromise surface and cause leaking. If scuffing occurs, following Manufacturer’s recommendation for repair.
4. Staples are not permitted.
5. Weather conditions:
    a. Do not leave underlayment exposed to weather more than thirty (30) days after beginning of underlayment installation even if Manufacture allows longer period of time.
    b. If underlayment is exposed for more than thirty (30) days after beginning of underlayment installation, treat as temporary roof under first paragraph above.
    c. If moisture is deposited on exposed underlayment, obtain written approval from Shingle Manufacturer's Representative before installing shingles.
6. Install valley secondary underlayment, valley primary underlayment, and valley metal after installation of general secondary underlayment, but before installation of general primary underlayment.

B. Primary Underlayment:
1. Apply 48 inch (1,200 mm) wide courses over complete deck, including areas covered with secondary underlayment unless specified otherwise.
    a. Overlap underlayment before fastening.
    b. Maintain end laps of 6 inch (150 mm) and side laps of 3 inch (76 mm).
    c. Stop primary underlayment between 3 and 6 inches (75 and 150 mm) of inside edge of strip of secondary underlayment installed over edge of formed valley metal.
2. Nailing Synthetic Underlayment:
    a. Use low-profile plastic or steel cap corrosion resistant nails with 1 inch (25 mm) diameter heads to fasten underlayment in place. (Fastening underlayment without caps is not permitted).
    b. Nails must be driven properly. Improperly driven fasteners such as over-driving, under-driving and nails driven at an angle are not permitted.
    c. Fasteners should be long enough to penetrate at least 3/4 inch (19 mm) into roof sheathing. Fasteners must be lie flush to roof deck at 90 degree angle to roof deck and tight with underlayment.
    d. Do not nail through metal flashing, except drip edge, when installing primary underlayment.
    e. Follow Shingle Manufacturer’s installation instructions for following:
        1) Securing underlayment to roof deck adjusting for roof slope nailing requirements.
        2) Side lap, end lap, and overlapping nailing requirements.
        3) Rake and eave nailing requirements.
        4) High wind condition nailing requirements.
        5) Sealants recommendations.

C. Secondary Underlayment:
1. Under Shingles:
    a. Lap end joints 6 inches (150 mm) and side joints 3 inch (76 mm) minimum.
    b. Apply continuous 12 inches (300 mm) wide strip at edge of eaves and rakes before installing drip edge.
    c. Apply two (2) 36 inch (900 mm) wide courses along eaves and rakes as described in Contract Documents with first course overlapping drip edge and 12 inches (300 mm) wide previously applied strip.
2. Steeple Base:

a. Secondary Underlayment installed as shown on Contract Drawings under Steeple.

D. Valley Underlayment:
   1. Apply three (3) continuous 36 inch (900 mm) wide sheets of secondary underlayment in valley lapped to provide 102 inch (2 590 mm) wide covered area centered over valley.
   2. Apply one (1) continuous 36 inch (300 mm) wide strip of primary underlayment atop secondary underlayment and centered over valley.
   3. Install formed valley metal over strip of primary underlayment.
      a. Nail top of each section and lap 8 inches (200 mm) in direction of flow.
      b. Seal laps with continuous bead of elastomeric roofing sealant.
      c. Secure edges of valley metal with fasteners spaced at 12 inches (300 mm) maximum on center and approximately 1/2 inch (13 mm) in from edge of metal.
   4. Install 12 inches (300 mm) wide strips of secondary underlayment lapping nailed edge of formed valley metal 3 inches (75 mm).

## 3.05 INSTALLATION - SHINGLES

A. Before installing shingles, inspect underlayment and metal installation with Architect and Owner . Correct improperly installed and damaged material before beginning shingle installation.

B. Racking installation method is not permitted by Owner and will be considered non-conforming work.

C. Starter shingles:
   1. Manufacturer’s starter shingles are required for Shingle Warranty.
   2. Install shingles at eaves and rakes in accordance with Shingle Manufacturer’s instructions.
   3. Cut shingles in accordance with Shingle Manufacturer's instructions, or use approved starter course.
   4. Nail to eave granule side up in continuous mastic bed with cut edge down-slope and edge overhanging eave 3/8 inch (9 mm) so sealing tabs are at edge of eave.
   5. Install shingles with maximum exposure recommended by Shingle Manufacturer.
   6. Lay first course directly over starter strip with ends flush with starter strip at eaves and so joints in starter strip are offset 4 inches (100 mm) minimum from joints in first course.

D. Lay shingles so end joints are offset in accordance with Shingle Manufacturer's installation procedures.

E. Insure alignment by snapping chalk line at least each fifth course to control horizontal and vertical alignment.

F. Run courses true to line with end joints properly placed. Leave shingles flat without wave and properly placed.

G. Hip and ridge shingles:
   1. Manufacturer’s hip and ridge shingles are required for Shingle Warranty.
   2. Install specified hip and ridge shingles in accordance with Shingle Manufacturer's instructions.
   3. Run ridge shingles as directed by Architect.

H. Nailing:
   1. General:
      a. Six (6) Nail Pattern as recommended by Shingle Manufacturer for Shingle Warranty in each shingle.
      b. Place in relation to top edge of shingle as required by Shingle Manufacturer.

c. Place nails one inch (25 mm) from each end of shingle and remainder evenly spaced between.
d. Should any nail fail to penetrate sheathing by 1/4 inch (6 mm) minimum, drive additional nail nearby.

2. Nailing guns:
a. Nails must be driven properly. Improperly driven fasteners such as over-driving, under-driving and nails driven at an angle are not permitted.
b. Adjust nail gun pressure for nailing flush and tight to deck without cutting shingle surface.
c. Drive nails perpendicular to shingle surface so nail head is flat against shingle.
d. Should any nail fail to penetrate sheathing by 1/4 inch (6 mm) minimum, drive additional nail nearby.

I. Hand-Sealing:
1. If ambient temperature or exposure to sun will not be sufficient to secure adhesive strip to under-lying shingle within one week, hand seal shingles with elastomeric roofing sealant.

J. Over valley metal:
1. Do not drive nails through valley metal.
2. Run chalk line so valley metal will be exposed 6 inches (150 mm) wide at top and diverge 3/32 inch (one mm) per ft (300 mm) down to eaves.
3. Neatly trim shingles to this line.
4. Seal trimmed shingle edges to valley metal with continuous bead of elastomeric roofing sealant applied within one inch (25 mm) of shingle edge.

K. Vent pipe sleeve flange:
1. Vent pipe sleeve flange as specified in Section 07 6310.
2. Fit shingles under lower edge and over sides and upper edge.
3. Set vent pipe flange in elastomeric roofing sealant.
4. Embed shingles in elastomeric roofing sealant where they overlap flange.
5. Apply bead of elastomeric roofing sealant at junction of vent pipe and vent flashing.

## 3.06 INSTALLATION ACCESSORIES

A. Steeple:
1. Install products following below Steeple as shown on Contract Drawings:
a. Square tube pipe boot.
b. Secondary underlayment.

## 3.07 FIELD QUALITY CONTROL

A. Non-Conforming Work:
1. Correct any work found defective or not complying with Contract Document requirements at no additional cost to the Owner.
2. Raking installation method is not permitted by Owner and will be considered to be not complying with Contract Document requirements and must be corrected at no additional cost to Owner.

## 3.08 CLEANING

A. General:
1. All tools and unused materials must be collected at end of each workday and stored properly off finished roof surface and protected from exposure to elements.
2. Leave metals clean and free of defects, stains, and damaged finish.

a. Replace fascia metal that is scratched through finish to base metal.

3. Properly clean finished roof surface after completion.
4. Verify drains and gutters are not clogged.
5. Clean shingles and building of soiling caused by this installation.
6. Clean and restore all damaged surfaces to their original condition.

B. Waste Management:

1. Disposal:
   a. All work areas are to be kept clean, clear and free of debris always.
   b. Do not allow trash, waste, or debris to collect on roof. These items shall be removed from roof daily.
   c. Remove debris resulting from work of this Section from roof and site. Dispose of or recycle all trash and excess material in manner conforming to current EPA regulations and local laws.

**3.09 PROTECTION**

A. Do not permit traffic over finished roof surface; protect roofing until completion of project.

**END OF SECTION 07 3113**

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**SECTION 07 6200**
**SHEET METAL FLASHING AND TRIM**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, sheet metal roofing, exterior penetrations, and other items indicated in Schedule.

B. Sealants for joints within sheet metal fabrications.

### 1.02 DEFINITIONS

A. Base Flashing: That portion of flashing attached to or resting on roof deck to direct flow of water onto the roof covering.

B. Cap Flashing: Material used to cover top edge of base flashings or other flashings to prevent water seepage behind base flashing. Cap flashing overlaps base flashing.

C. Collar: Pre-formed flange placed over vent pipe to seal roof around vent pipe opening. Also called vent sleeve.

D. Drip Edge: Non-corrosive, non-staining material used along eaves and rakes to allow water runoff to drip clear of underlying building.

E. Flange: Metal pan extending up and down roof slope around flashing pieces. Usually at plumbing vents.

F. Flashing: Components used to prevent seepage of water into a building around any intersection or projection in a roof such as vent pipes, adjoining walls, and valleys.

G. Metal Flashing: Roof components made from sheet metal that are used to terminate roofing membrane or other material alongside roof perimeters as well as at roof penetrations.

H. Penetration: Any object that pierces surface of roof.

I. Pipe Boot: Prefabricated flashing piece used to flash around circular pipe penetrations. Also known as a Roof Jack.

J. Roof Jack: Term used to describe a Pipe Boot or Flashing Collar.

K. Valley: Internal angle formed by intersection of two sloping roof planes to provide water runoff.

L. Vent: Any outlet for air that protrudes through roof deck such as pipe or stack. Any device installed on roof, gable or soffit for purpose of ventilating underside of roof deck.

M. Vent Sleeve: See collar.

### 1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2022.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).

### 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 MANUFACTURERS

A. Galvanized Sheet Metal Flashing and Trim Manufacturers:
   1. Acceptable Manufacturers Of Metal:
      a. CMG - Coated Metals Group, Denver, CO www.cmgmetals.com.
      b. Drexel Metals, LLC, Ivyland, PA www.drexmet.com.
      c. Fabral, Lancaster, PA www.fabral.com.
      d. Firestone Metal Products, Anoka, MN www.unaclad.com.
      e. MBCI, Houston, TX www.mbci.com.
      f. Metal Sales Manufacturing Corp, Sellersburg, IN www.mtlsales.com.
      g. O'Neal Flat Rolled Metals (member of O'Neal Industries), Brighton, CO www.ofrmetals.com.
      h. Petersen Aluminum Corp, Elk Grove, IL www.pac-clad.com.
      i. Ryerson, Chicago, IL www.ryerson.com.

### 2.02 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.
   1. 16 ga (1.262 mm) for metal protective cover.
   2. 22 ga (0.792 mm) for hold-down clips.
   3. 24 ga (0.635 mm) for all other.

B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; shop pre-coated with PVDF coating.
   1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: **BONE WHITE.** As selected by Architect from manufacturer's standard colors.
   3. Thickness:
      a. 16 ga (1.262 mm) for metal protective cover.
      b. 22 ga (0.792 mm) for hold-down clips.
      c. 24 ga (0.635 mm) for all other.

### 2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

### 2.04 FACTORY FABRICATED ITEMS

A. Galvanized Reglets:
   1. Acceptable Products:
      a. Fry Springlock Reglets by Fry Reglet Corp, Alhambra, CA www.fryreglet.com.

B. Stainless Steel Reglets:
   1. Acceptable Products:

a. Fry Springlock Reglets by Fry Reglet Corp, Alhambra, CA www.fryreglet.com.

C. Metal Soffit Panels:
1. Performance:
a. Design Criteria:
1) Flush panel design.
(a) Panels shall be interlocked full length of panel.
(b) Panel widths shall be Manufacturer's standard.
2) Performance Standard: ATAS Wind-LOK Soffit MPS120.
3) Perforation a required option where indicated. Perforated full width of panel with holes designed so one dimension does not exceed 1/8 inch.
2. Materials:
a. 0.032 inch thick minimum 3105-H24 alloy aluminum meeting requirements of ASTM B209.
b. 24 ga galvanized steel meeting requirements of ASTM A653/A653M, G 90.
c. 24 ga minimum 50 ksi galvalume steel meeting requirements of ASTM A792/A792M AZ-55.
3. Fabrication:
a. Panels shall be uniformly dimensioned, roll formed to lengths to avoid trimming.
b. Panel system shall be anchored as recommended by Manufacturer.
c. Panels shall be continuous.
4. Finish:
a. Polyvinylidene Fluoride (PVF2) Resin-base (Kynar 500 or Hylar 5000) finish for coil coating components containing 70 percent minimum PVF2 in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
5. Color: **BONE WHITE.** As selected by Architect from Manufacturer's standard colors.
6. Accessories:
a. Continuous Soffit Vent:
b. Acceptable Products:
1) Aluminum 8.8 sq in net free ventilation per lineal foot. Width: 2 inches. Color: white or brown.
(a) Mastic VAS70 Vent-A-Strip (Model 70) by Mastic Home Exteriors by Ply Gem Chicago, IL www.mastic.com/.
2) Aluminum 9.9 sq in net free ventilation per lineal foot. Width: 2-1/4 inches. Color: white or brown.
(a) Mastic VAS79 Vent-A-Strip (Model 79) by Mastic Home Exteriors by Ply Gem Chicago, IL www.mastic.com/.

D. Installation:
1. Conceal fasteners where possible. Paint heads of exposed fasteners to match background.
2. Isolate from dissimilar metals to prevent electrolytic action.

## 2.05 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers of strength and type consistent with function.

B. Concealed Sealants: Non-curing butyl sealant.

C. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

D. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

### 3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. 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. Install with small, watertight seams.

B. Slope to provide positive drainage.

C. Provide sufficient hold down clips to insure true alignment and security against wind.

D. Provide 4 inch (100 mm) minimum overlap.

E. Allow sufficient tolerance for expansion and contraction.

F. Insulate work to prevent electrolytic action.

G. Roof Diverter (Kickout Diverter):
   1. Extend roof diverter 1 inch (25 mm) minimum beyond face edge of lower roof.
   2. Extend underlayment vertically up wall behind flashing.
   3. Solder all joints.
   4. Apply sealant.

### 3.04 CLEANING

A. Leave metals clean and free of defects, stains, and damaged finish.

### 3.05 SCHEDULE

A. Roof Diverter:
   1. Roof Diverter (Kickout Diverter) required when vertical wall extends beyond lower roof.
      a. 24 ga (0.635 mm) pre finished galvanized steel meeting requirements for sheet metal specified in materials above.
      b. Size: 6 inch x 6 inch by 12 inches length.

B. Step Flashing:
   1. Step flashing required for steep slope for roof to wall flashing.
      a. 24 ga pre-finished galvanized steel meeting requirements for sheet metal specified in materials above.
      b. Size: 5 inch x 5 inch by 8 inch or 12 inches length.

C. Asphalt Shingle Flashing:
   1. Including Formed Valley Metal, Pipe flashing for vent piping and flues, Roof jacks, Saddles and curb flashings, Miscellaneous flashing.
   2. Formed Valley Metal And Drip Edge:
      a. Material: Aluminum: 0.032 inch thick minimum or Steel: Minimum 24 ga, hot-dipped galvanized to meet requirements of ASTM A653/A653M, 1.25 oz/sq ft. or galvalume meeting requirements of ASTM A792/A792M AZ50, 50 ksi.

b. Profile: Form accurately to details. Provide formed valley metal in 10 foot lengths with one inch 'V' crimp and break in center to match roof slopes. Profiles, bends, and intersections shall be even and true to line.

D. Gutters and Downspouts:
   1. Materials
      a. Aluminum:
         1) Downspouts: Rectangular 0.032 inch (0.813 mm) minimum aluminum including necessary elbows.
         2) Gutters: 0.04 inch (1.0 mm) minimum aluminum.
         3) Brackets: 0.06 inch (1.52 mm) minimum aluminum.
      b. Screws, Bolts, Nails, And Accessory Fasteners: Non-corrosive and of strength and type consistent with function.
      c. Downspouts, gutters, brackets, fasteners, and accessories shall be compatible material.
   2. Fabrication:
      a. Fabricate in accordance with SMACNA Architectural Manual recommendations, where applicable.
      b. Cross-sectional configuration of gutter shall be Style A, (Page 1.13 6th Edition) of SMACNA Architectural Manual.
      c. Form accurately to details.
      d. Profiles, bends, and intersections shall be even and true to line.
   3. Finishes:
      a. Metal exposed to view shall have face coating of Polyvinylidene Fluoride (PVF2) Resin-base finish (Kynar 500 or Hylar 5000) containing seventy (70) percent minimum PVF2 in resin portion of formula.
         1) Thermo-cured two (2) coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
         2) Reverse side coating shall be thermo-cured system consisting of corrosion inhibiting epoxy primer applied over properly pre-treated metal.
      b. Color: **BONE WHITE.** As selected by Architect from Manufacturer's standard colors.
   4. Installation:
      a. Allow no more than 40 feet between downspouts. Lap joints in downspouts 1-1/2 inches minimum in direction of water flow.
      b. Furnish and install outlet tubes and gutter ends where required. Furnish and install expansion joints in runs exceeding 50 feet and in runs that are restrained at both ends. Lap other joints in gutter one inch minimum, apply sealant in lap, and stainless steel rivet one inch on center maximum.

E. Aluminum Fascia:
   1. Materials:
      a. Aluminum: 0.032 inch thick minimum complete with accessories recommended by Manufacturer for proper installation.
   2. Finishes:
      a. Face coating Polyvinylidene Fluoride (PVF2) Resin-base finish (Kynar 500 or Hylar 5000) for coil coating components containing 70 percent minimum PVF2 in resin portion of formula. Thermocured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
      b. Color: **BONE WHITE.** As selected by Architect from Manufacturer's standard colors.
   3. Fabrication: Fascia may either be shop-fabricated using metal from a specified manufacturer, or a factory-fabricated standard system from a specified manufacturer.

F. Roof Jacks For Metal Flues: Factory-made galvanized steel.

G. Pipe Flashing For Concentric Piping Flashing Retrofitting:
   1. Description:
      a. Black EPDM Pipe flashing for existing Concentric Piping for reroofing existing roofs (cutting Concentric Roof Termination cap off and replacing is not permitted).
      b. Weather resistance to withstand ultra violet light and ozone.
      c. Malleable base to conform to different roof pitches.
      d. Pipe size: 1/2 inch to 4 inch.
         1) On-site customization.
      e. Fasteners included.
   2. Acceptable Products:
      a. Aztec RF101BP.

H. Pipe Flashing For Plumbing Vent Lines metal flues, and HVAC Air Piping: Ultra-pure high consistency molded one hundred (100) percent silicone rubber pipe boot that prevents cracking and splitting for life of roof.
   1. Product:

**END OF SECTION**

**SECTION 07 7100**
**ROOF SPECIALTIES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Manufactured roof specialties, including vents.

### 1.02 REFERENCE STANDARDS

A. 29 CFR 1910, Subpart D - Walking-Working Surfaces, 1910.21-1910.30; current edition.

B. 29 CFR 1910.23 - Ladders; Current Edition.

C. 29 CFR 1910.27 - Scaffolds and Rope Descent Systems; Current Edition.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2022.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

G. FBC TAS 201 - Impact Test Procedures; Testing Application Standard; 1994.

H. ICC (IBC)-2018 - International Building Code; 2018.

I. NRCA (RM) - The NRCA Roofing Manual; 2019.

### 1.03 SUBMITTALS

A. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

C. Manufacturer Instructions:
   1. Design details.
   2. Published ridge vent installation instructions.
   3. Storage and handling requirements.

D. Certificates:
   1. Manufacturer's Certificates of compliance showing products meet or exceed specified requirements.

E. Tests And Evaluation Reports:
   1. Manufacturer's test reports.
   2. Wind speed coverage for warranted wind speed.
   3. Florida Certificate of Product Approval.
   4. Notice of Acceptance (NOA).

F. Special Procedure Submittals:
   1. Contact Owner’s Representative (FM Group or Project Manager) for following information:
      a. Installer to include following mandatory information for Warranty Information to be given to Ridge Vent Manufacturer to be added to Manufacturer Warranty included with Closing Submittals:
         1) Name of Owner (name of FM Group)
            _____
         2) Mailing Address (FM office address)
            _____

3) Property ID
_____
4) Site address:
_____
5) Installation of Ridge Vent (or Roof Completion) Date _____
6) Any addition data required from Ridge Vent Manufacturer.

G. Informational Submittals:
1. Manufacturers' Instructions:
a. Roof Hatch:
1) Indicate installation requirements and rough-in dimensions.

H. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Warranty Documentation:
1) Final, executed copy of Warranty including Installer project information.

## 1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Wind Speed:
a. As required to meet local codes having jurisdiction.

B. Qualifications:
1. Manufacturer:
a. Company specializing in manufacturing products specified with this section with at least five (5) years experience and no known failures of specified product manufactured.

C. Pre-Installation Conference:
1. Participate in pre-installation conference held jointly with Section 07 3113.
2. In addition to agenda items specified in Section 01 3000, review following:
a. Review if Project is in high wind area.
b. Review Ridge Vent Manufacturers ventilation cutout requirements on roof deck and location of ventilation cutouts shown on Contract Documents.

D. Sequencing:
1. Coordinate installation with roof membrane.
2. Installation of ridge vent system.
3. Installation of conductor cable, air terminal base, and air terminal attached to 'Lightning Rod Cover Plate' by Section 26 4100.

## 1.05 WARRANTY

A. Manufacturer Warranty:
1. General:
a. Ridge vent system will provide calculated net free area (NFA) stated design.
b. Warranty starts at completion of installation.
c. Warranty covers replacement cost excluding labor and any costs involved with repairing or replacing other roofing or building materials.
2. Manufacturer's thirty (30) year warranty covering:
a. Kynar 500 paint and finish warranty covering color fade, chalk, and film integrity for ridge vent system.
3. Manufacturer's twenty (20) year warranty covering:
a. Ridge vent system to be free from defects that will affect its performance.

b. Ridge vent system will withstand winds up to 120 mph (193 kph) average wind speed.
c. Ridge vent system will withstand snow load.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Ridge Vents:
1. Manufacturers:
a. Manufacturers And Products. See Section 01 6000:
1) Metal-Era Airflow Solutions, Waukesha, WI www.metalera.com.
(a) Contact Information: Kevin Brown (800) 558-2162, 262-436-6258, thechurch@metalera.com, kevin.brown@metalera.com
2) Western Metal Products, LC, Woods Cross, UT www.westernmetalproducts.com.
(a) Contact Information: James Rohletter, phone (888) 298-3454, email rvbid@westernmetalproducts.com
3) Morris Architectural Metals, Temple, GA www.morrisam.com
(a) Contact Information: William Morris (678)-631-7130, 404-480-0353, email: william.morris@morrisam.com

### 2.02 COMPONENTS

A. Engineered Roof Ventilation:
1. Ridge Vent System: Factory fabricated, formed panels with integral attachment flanges and snap-on cover.
a. Ridge Vent:
1) Basis of Design:
(a) Basis of Design Approved Product:
(1) LDS HI-PERF High Velocity Ridge Vent by Metal-Era.
(b) Basis of Design Approved Equivalent Product:
(1) Ridge Vent by Western Metal.
(2) Ridge Vent by Morris Architectural Metals
2) Design Criteria:
(a) Not approved on roof mean heights greater than 33 feet (10 m).
(b) Weather-proof and bug-proof ventilation system.
(c) Withstand winds up to 120 mph (193 kph) average wind speed.
(d) Provide net free area (NFA) requirements as determined by vented roof deck system and eave condition as indicated on Contract Drawings.
3) Slope to High Wall Version:
(a) Approved Products. See Section 01 6000:
(1) Model HPSH by Metal-Era.
(2) Model: ASRP1 by Western Metal.
(3) Model: VSW Headwall by Morris Architectural Metals
4) Slope to Slope Version:
(a) Approved Products.
(1) Model HPSS by Metal-Era.
(2) Model: ASRP2 by Western Metal.
(3) Model: VSS Ridge by Morris Architectural Metals
5) Net free area (NFA):
(a) Net free area: To be calculated by Ridge Vent Manufacturer for project.

b. Components:
    1) Approved Product:
        (a) Basis of design for System Components for this Project is Metal-Era Ridge Vent.
        (b) Basis of design approved equivalent system components for this Project is Western Metal or Morris Architectural Metals.
    2) Ridge vent system comprising of following:
        (a) Cover plate 8 inch wide at each joint over ridge vent cover.
        (b) Continuous deflector with baffle.
        (c) Continuous Z bracket with intermittent spacer at 12 inch on center to supporting ridge cover.
        (d) End cap / cover plate.
        (e) Expanded metal support screen.
        (f) Fasteners.
        (g) Intermittent spacers at 12 inch on center directly under ridge vent cover.
        (h) Ridge vent cover in 12 feet length.
    3) Metal:
        (a) 24 ga (0.0276 in) minimum hot-dipped galvanized to meet requirements of ASTM A653/A653M, 1.25 oz per sq ft or galvalume meeting requirements of ASTM A792/A792M AZ50.
        (b) Aluminum: 0.040 inch, 0.050, 0.063 inch.
    4) Expanded metal support screen:
        (a) 0.050 inch 3003-H14 formed aluminum with minimum of 48 percent open area.
    5) Z brackets: 20 gauge (0.0396 in) G90 galvanized steel.
    6) Deflector: 24 ga (0.0276 in) minimum.
c. Finish: Manufacturer's standard polyvinylidene fluoride (PVDF) coating. Polyvinylidene Fluoride ($PV_2$) Resin-base finish (Kynar 500) for coil coating components containing seventy (70) percent minimum $PVF_2$ in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
d. Finish Color: Medium Bronze.

**2.03 ACCESSORIES**

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. General Sealant: Weathersealing expansion, contraction, perimeter, and other movement joint sealant.
    1. Design Criteria:
        a. As specified in Section 07 9200 - Joint Sealants.
        b. Meet following standards for Sealant:
            1) ASTM C920: Type S Grade NS, Class 25 (min) Use O.
            2) 100 percent silicone.
    2. Approved Products. See Section 01 6000:
        a. Dow Corning: 790 Silicone Building Sealant.
        b. Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS2350 Silicone Elastomeric Sealant.
        c. Tremco: Tremsil 600 Silicone Sealant.

C. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

D. Insulation Board Adhesive: Two-component, low-rise polyurethane foam adhesive used for adhering insulation to low slope roof deck materials.

E. Ridge Vent System:
   1. End Caps, Cover Plates, and other accessories necessary for proper installation.

F. Fasteners:
   1. Ridge vent fastened to structure:
      a. Approved Fasteners:
         1) Basis of design: Metal-Era Ridge Vent.
         2) Basis of design approved equivalent: Western Metal or Morris Architectural Metals
      b. Fasteners shall be approved by Ridge Vent Manufacturer and provide minimum pull out resistance of 240 lbf (109 kg) into substrate when tested in accordance with TAS 105 test protocol.
         1) Screws:
            (a) #9 1-1/2 inches (38 mm) stainless steel screws.
            (b) Provided by Manufacturer.
         2) New Building:
            (a) #9 1-1/2 inches (38 mm) stainless steel screws.
            (b) Provided by Manufacturer.
            (c) Nailing permitted as per manufacturer’s instructions.

G. Lightning Rod Cover Plate:
   1. 'Lightning Rod Cover Plate' provided by Ridge Vent Manufacturer.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.
   1. Verify Ridge Vent Manufacturers ventilation cutout requirements on roof deck and location of ventilation cutouts shown on Contract Documents to verify correct location for all cutouts.
      a. Make adjustments to ventilation cutouts if necessary before installation of ridge vent.
   2. Examine deck to determine if it is satisfactory for installation of ridge vent system.
      a. Conditions include, but are not limited to, moisture on deck and protruding deck fasteners.
      b. Verify substrate is dry, clean and free of foreign matter.
   3. Do not begin installation until substrates have been properly prepared.

### 3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Ridge Vent:
   1. Clean roof sheathing, including removal of dirt, shingle nails, and debris, before installation of ridge vent system.
   2. Install in accordance with IBC Section 1503.2 'Flashing'.
   3. Install in accordance and as shown with Manufacturer's installation instructions for assembly of components and attachment to roof deck:

4. Use provided fasteners consistent with manufacturer's instructions, suitable for substrate to which it is being installed.
5. Attach to roof/wall structure with stainless steel screws provided by Manufacturer at spacing required by Manufacturer. All nail heads and vent section joints shall be sealed with silicone sealant.
6. Remove protective film before applying sealant.
7. Apply sealants as per Manufacturer's installation instructions.

E. Lightning Rod Cover Plate:
1. After installation of Ridge Vent:
a. Coordinate installation of conductor cable, air terminal base, and air terminal attached to 'Lightning Rod Cover Plate' with Section 26 4113.

**3.03 PROTECTION**

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

**3.04 CLEANING**

A. General:
1. Clean exposed surfaces per manufacturer's written instructions. Touch up damaged metal coatings.

B. Waste Management:
1. Disposal:
a. Remove debris resulting from work of this Section from roof and site in approved waste receptacle.

**END OF SECTION 07 7100**

**SECTION 07 8400**
**FIRESTOPPING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

### 1.02 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).

C. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.

D. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020a.

E. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.

F. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).

G. ITS (DIR) - Directory of Listed Products Current Edition.

H. FM (AG) - FM Approval Guide current edition.

I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

J. UL (DIR) - Online Certifications Directory Current Edition.

K. UL (FRD) - Fire Resistance Directory Current Edition.

L. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

B. Identify locations where each type of Penetration Firestop System is to be installed.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Installer's qualification statement.

### 1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Conform to applicable building codes for fire resistance ratings.
   2. Comply with installation requirements and protocol outlined in Firestop Contractors International Association 'FICIA 'Manual of Practice' handbook.

3. Each Penetration Firestop System shall be UL/ULC listed for that type of penetration occurring on Project.
4. Ratings shall be in accordance with ASTM E814, UL 1479, or IBC Section 703, "Fire-Resistance Ratings And Fire Tests' as acceptable to local code authority.
    a. Provide Firestop Systems with F Ratings not less than Fire-Resistance Rating of Constructions penetrated.
    b. Provide Firestop Systems with T and F Ratings, as determined per ASTM E814.
    c. Provide Joint Sealants with Fire-Resistance Ratings as determined per ASTM E119.
    d. Provide Products with Flame-Spread values of less than 25 and smoke developed values of less than 450, as determined per ASTM E84.
    e. Surface burning characteristics (per ASTM E84): 25 or less. Tested in accordance with UL 1479 or ASTM E814.

B. Coordination:
1. Coordinate construction of openings and penetrating items to ensure that firestopping assemblies are installed in compliance with specific requirements.
2. Coordinate sizes of sleeves, openings, core drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Sequencing:
1. Perform work of this section in proper sequence to prevent damage to firestop system and to ensure installation will occur prior to enclosing or concealing work. Firestopping shall precede finishing of gypsum board.
    a. Do not conceal firestopping installations until inspection agency or authorities having jurisdiction, as required, have examined each installation.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section and:
1. Installer who is certified and licensed or qualified by firestopping manufacturer as having been provided necessary training to install firestop products per specified requirements with not less than five (5) years of documented experience.
2. Trained by manufacturer.
3. Upon request, submit documentation.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Deliver firestopping materials to Project Site in original, new unopened containers or packages bearing manufacturer’s printed labels.

B. Storage And Handling Requirements:
1. Store and handle firestopping materials in compliance with manufacturers written instructions.
2. Protect materials from freezing or overheating and to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes.
3. Store materials off floor at temperatures between 40 deg F (4.4 deg C) and 90 deg F (32.2 deg C) or as re

## 1.06 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.

## 1.07 WARRANTY

A. Manufacturer Warranty:
   1. Firestop materials shall be free from cracking, checking, dusting, flaking, spalling, separation, and blistering for period of 10 years from Date of Substantial Completion. Reinstall or repair such defect or failures at no cost to Owner.

# PART 2 PRODUCTS

## 2.01 MATERIALS

A. Acceptable Manufacturers:
   1. Members of International Firestop Council www.firestop.org and member in good standing.
   2. Equal as approved by Architect before installation. See Section 01 6200.

B. Sealant, packing material, or collar system required by Firestop Manufacturer for Firestop Penetration System to comply with listed design.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

## 2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

D. Through Penetration Firestopping: Use 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: Provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

E. Firestop Tracks (Metal Stud Framing):

1. Metal Stud Manufacturer's top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly by factory applied cured intumescent fire stop material affixed to steel profile; in thickness, not less than indicated for studs and in width to accommodate depth of studs.
    a. Acceptable Products:
        1) BlazeFrame Deflection Track by ClarkDietrich Building Systems.
        2) Equal as approved by Architect before bidding. See Section 01 6200.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

B. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

C. Verify ducts, piping, equipment, and other similar items that would interfere with application of firestopping shall be in place.

D. Do not commence Work until unsatisfactory conditions have been corrected.
    1. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

### 3.02 PREPARATION

A. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

B. Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work. Remove tape as soon as it is possible to do so without disturbing firestopping seal with substrates.

C. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

D. Remove incompatible materials that could adversely affect bond.

E. Do not apply firestopping materials to surfaces which have been previously painted or treated with sealer, curing compound, water repellent, or other similar coating, unless application has been accepted by manufacturer of firestopping products.

F. Install backing materials to prevent liquid material from leakage.

### 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 Owner's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

D. 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 off excess fill materials and sealants adjacent to penetrations by methods and cleaning materials recommended by manufacturers of firestopping products and of products in which penetrations occur.

**3.06 PROTECTION**

A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

**SECTION 07 9200**
**JOINT SEALANTS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sealants not specified to be furnished and installed under other Sections.
   2. Quality of sealants to be used on Project not specified elsewhere, including submittal, material, and installation requirements.

B. Related Requirements:
   1. Removing existing sealants specified in Sections where work required.
   2. Furnishing and installing of sealants is specified in Sections specifying work to receive new sealants.
   3. Section 07 2400: Sealants for EIF Systems.

C. Products Furnished But not Installed Under This Section:
   1. Interior Ceramic Tile Joint Sealants:

D. Related Requirements:
   1. Section 09 3000: 'Tiling'.

### 1.02 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM C920-14a, ‘Standard Specification for Elastomeric Joint Sealants’.
      b. ASTM C1193-16, ‘Standard Guide for Use of Joint Sealants’.
      c. ASTM C1330-02(2013), ‘Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants’.
      d. ASTM C1481-12(2017) 'Standard Guide for Use of Joint Sealants with Exterior Insulation & Finish Systems (EIFS)'.
      e. ASTM D5893/D5893M-16, ‘Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements’.

### 1.03 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 C1193 - Standard Guide for Use of Joint Sealants 2016.

C. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.

D. ASTM C1481 - Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS) 2012.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

H. ASTM C834 - Standard Specification for Latex Sealants 2017.

I. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.

J. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.
   2. Ensure sealants are cured before covering with other materials.

## 1.05 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
      b. Manufacturer's literature for each Product.
      c. Schedule showing joints requiring sealants. Show also backing and primer to be used.

B. Informational Submittals:
   1. Certificates:
      a. Manufacturer's Certificate:
         1) Certify products are suitable for intended use and products meet or exceed specified requirements.
         2) Certificate from Manufacturer indicating date of manufacture.
   2. Manufacturers' Instructions:
      a. Manufacturer's installation recommendations for each Product.
      b. Manufacturer's installation for completing sealant intersections when different materials are joined.
      c. Manufacturer's installation for removing existing sealants and preparing joints for new sealant.

## 1.06 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten (10) years documented experience.
   2. Applicator Qualifications:
      a. Company specializing in performing work of this section.
      b. Provide if requested, reference of projects with minimum three (3) years documented experience, minimum three (3) successfully completed projects of similar scope and complexity, and approved by manufacturer.
      c. Designate one (1) individual as project foreman who shall be on site at all times during installation.

B. Preconstruction Testing:
   1. Pre-construction testing is not required when sealant manufacturer can furnish data acceptable to Architect based on previous testing for materials matching those of the Work.

C. Mockups:
   1. Provide mockups including sealant and joint accessories to illustrate installation quality and color if requested by Architect or Project Manager.
      a. Incorporate accepted mockup as part of Work.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Deliver and keep in original containers until ready for use.
   2. Inspect for damage or deteriorated materials.

B. Storage and Handling Requirements:
   1. Handle, store, and apply materials in compliance with applicable regulations and material safety data sheets (MSDS).
   2. Handle to prevent inclusion of foreign matter, damage by water, or breakage.
   3. Store in a cool dry location, but never under 40 deg F (4 deg C) or subjected to sustained temperatures exceeding 80 deg F (27 deg C) or as per Manufacturer's written recommendations.
   4. Do not use sealants that have exceeded shelf life of product.

## 1.08 FIELD CONDITIONS

A. Ambient Conditions:
   1. Do not install sealant during inclement weather or when such conditions are expected. Allow wet surfaces to dry.
   2. Follow Manufacturer’s temperature recommendations for installing sealants.
   3. Ambient Conditions:
      a. Do not apply caulking at temperatures below 40 deg F (4 deg C).

## 1.09 WARRANTY

A. Manufacturer Warranty:
   1. Signed warranties against adhesive and cohesive failure of sealant and against infiltration of water and air through sealed joint for period of three (3) years from date of Substantial Completion.
      a. Manufacturer's standard warranty covering sealant materials.
      b. Applicator’s standard warranty covering workmanship.

# PART 2 PRODUCTS

## 2.01 SYSTEMS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Dow Corning Corp., Midland, MI www.dowcorning.com.
      b. Franklin International, Inc.  Columbus, OH www.titebond.com.
      c. GE Sealants & Adhesives (see Momentive Performance Materials Inc.).
      d. Laticrete International Inc., Bethany, CT www.laticrete.com.
      e. Momentive Performance Materials Inc. (formally GE Sealants & Adhesives), Huntersville, NC www.ge.com/silicones.
      f. Sherwin-Williams, Cleveland, OH www.sherwin-williams.com.
      g. Sika Corporation, Lyndhurst, NJ www.sikaconstruction.com or Sika Canada Inc, Pointe Claire, QC www.sika.ca.
      h. Tremco, Beachwood, OH www.tremcosealants.com or Tremco Ltd, Toronto, ON (800) 363-3213.

B. Materials:
   1. Design Criteria:
      a. Compliance: Meet or exceed requirements of these standards:
         1) ASTM C920: Elastomeric joint sealant performance standard.
         2) ASTM D5893/D5893M: Silicone Joint Sealant for Concrete Pavements.

b. Comply with Manufacturer’s ambient condition requirements.
c. Sealants must meet Manufacturer's shelf-life requirements.
d. Sealants must adhere to and be compatible with specified substrates.
e. Sealants shall be stable when exposed to UV, joint movements, and environment prevailing at project location.
f. Primers (Concrete, stone, masonry, and other nonporous surfaces typically do not require a primer. Aluminum and other nonporous surfaces except glass require use of a primer. Installer Option to use Adhesion Test to determine if primer is required or use primer called out in related sections):
    1) Adhesion Test:
        (a) Apply silicone sealant to small area and perform adhesion test to determine if primer is required to achieve adequate adhesion. If necessary, apply primer at rate and in accordance with Manufacturer’s instructions. See ‘Field Quality Control’ in Part 3 of this specification for Adhesive Test.
    2) If Primer required, shall not stain and shall be compatible with substrates.
    3) Allow primer to dry before applying sealant.

2. Sealants At Exterior Building Elements:
    a. Description:
        1) Weathersealing expansion, contraction, perimeter, and other movement joints which may include all or part of the following for project:
            (a) Aluminum entrance perimeters and thresholds.
            (b) Columns.
            (c) Connections.
            (d) Curtainwalls.
            (e) Door frames.
            (f) EIFS to metal joints.
            (g) Joints and cracks around windows.
            (h) Louvers.
            (i) Masonry.
            (j) Wall penetrations.
            (k) Other joints necessary to seal off building from outside air and moisture.
    b. Design Criteria:
        1) Meet following standards for Sealant:
            (a) ASTM C920: Type S, Grade NS, Class 50 Use NT, M, G, A.
        2) Limitations:
            (a) Do not use below-grade applications.
            (b) Do not use on surfaces that are continuously immersed or in contact with water.
            (c) Do not use on wet, damp, frozen or contaminated surfaces.
            (d) Do not use on building materials that bleed oils, plasticizers or solvents, green or partially vulcanized rubber gaskets or tapes.
        3) Color:
            (a) Architect to select from Manufacturer's standard colors.
            (b) Match building elements instead of window (do not use white that shows dirt easily).
    c. Approved Products. See Section 01 6000:
        1) Dow Corning:
            (a) Primer: 1200 Prime Coat.
            (b) Sealant: 791 Silicone Weatherproofing Sealant.

2) Momentive Performance Materials (formerly, GE Sealants & Adhesives):
   (a) Primer: SS4044 Primer.
   (b) Sealant: GE SCS2000 SilPruf Silicone Sealant & Adhesive.
3) Tremco:
   (a) Primer:
      (1) Metal surface: No. 20 primer.
      (2) Porous surfaces: No. 23 primer.
   (b) Sealant: Spectrum 1 Silicone Sealant.

3. Sealants At EIFS:
   a. Description:
      1) Weatherproofing sealant for long term resistance to natural weathering, including: ultraviolet radiation, high and low temperatures and rain and snow, with negligible change in elasticity. May be used for application to horizontal or vertical surfaces.
   b. Design Criteria:
      1) Meet following standards for Sealant:
         (a) Used to seal EIFS to EIFS, not EIFS to other material.
         (b) ASTM C920: Type S, Grade NS, Class 100/50 Use NT, A, G, O.
         (c) ASTM C1481 guidelines for use of sealant with EIFS.
      2) Limitations:
         (a) Do not use in structural glazing applications.
         (b) Do not use on surfaces that are underwater or in continuous contact with water.
         (c) Do not use on porous substrates.
         (d) Do not use on wet, damp, frozen or contaminated surfaces.
         (e) Do not use on surfaces where staining or discoloration may be concern, without prior testing.
         (f) Do not use on excessively basic or acidic substrates.
      3) Color:
         (a) Architect to select from Manufacturer's standard colors.
         (b) Match building elements (do not use white that shows dirt easily).
   c. Approved Products. See Section 01 6000:
      1) Dow Corning:
         (a) Primer: 1200 Prime Coat.
         (b) Sealant: 790 Silicone Building Sealant.
      2) Momentive Performance Materials (formerly, GE Sealants & Adhesives):
         (a) Primer: SCP3195P Primer.
         (b) Sealant: GE SCS2700 SilPruf LM Silicone Weatherproofing Sealant.
      3) Sika:
         (a) Primer: Sikaflex Primer 429.
         (b) Sealant: Sikaflex 2C NS Non-Sag Silicone Sealant.
      4) Tremco:
         (a) Primer: Porous surfaces: No. 23 primer.
         (b) Sealant: Spectrum 1 Silicone Sealant.

4. Sealants At Exterior Sheet Metal And Miscellaneous:
   a. Description:
      1) Weathersealing expansion, contraction, perimeter, and other movement joints which may include all or part of the following for project:

(a) Flashings.
(b) Gutters.
(c) Penetrations in soffits and fascias.
(d) Roof vents and flues.
(e) Lightning protection components.

b. Design Criteria:
1) Meet following standards for Sealant:
(a) ASTM C920: Type S Grade NS, Class 25 (min) Use NT, M, G, A and O.
2) Limitations:
(a) Do not use below-grade applications.
(b) Do not use on surfaces that are continuously immersed or in contact with water.
(c) Do not use on wet, damp, frozen or contaminated surfaces.
(d) Do not use on building materials that bleed oils, plasticizers or solvents, green or partially vulcanized rubber gaskets or tapes.

c. Approved Products. See Section 01 6000:
1) Dow Corning: 790 Silicone Building Sealant.
2) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS2350 Silicone Elastomeric Sealant.
3) Tremco: Tremsil 600 Silicone Sealant.

5. Sealants At Expansion Joints in Exterior Concrete (Aprons, Entryway Slabs, Mowstrips, Retaining Walls, Sidewalks):

a. Expansion Joints:
1) Design Criteria:
(a) Meet following standards for Sealant:
(1) ASTM C920: Type S, Grade NS, Class 100/50 Use T, NT, M, G, A, and O.
2) Sealant required at expansion for following areas:
(a) Between entryway slabs and building foundations.
(b) Between sidewalks and building foundations.
(c) Miscellaneous vertical applications.
3) Sealant NOT required at expansion joints for following areas:
(a) Within aprons and where aprons abut building foundations and sidewalks.
(b) Within mowstrips and where mowstrips abut building foundations and sidewalks.
(c) Within sidewalks.
4) Approved Products. See Section 01 6000:
(a) Dow Corning:
(1) Primer: 1200 Prime Coat.
(2) Sealant: 790 Silicone Building Sealant.
(b) Sika:
(1) Primer: Sikasil Primer-2100.
(2) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.

b. Penetrations thru Concrete Walls:
1) Design Criteria:
(a) Meet following standards for Sealant:
(1) ASTM C920: Type S, Grade NS, Class 100/50 Use T, NT, M, G, A, and O.

2) Approved Products. See Section 01 6000:
   (a) Dow Corning:
      (1) Primer: 1200 Prime Coat.
      (2) Sealant: 790 Silicone Building Sealant.
   (b) Sika:
      (1) Primer: Sikasil Primer-2100.
      (2) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.

6. Sealants At Control Joints in Exterior Concrete (Aprons, Entryway Slabs, Mowstrips, Retaining Walls, Sidewalks):
   a. Control Joints:
      1) Design Criteria:
         (a) Meet following standards for Sealant:
            (1) ASTM C920, Type S, Grade P, Class 100/50; Use T, M, G, A, O.
      2) Sealant required at control joints in following areas:
         (a) Retaining walls.
         (b) Miscellaneous vertical applications.
      3) Sealant is NOT required at control joints, unless needed to protect moisture sensitive soils or by Contract Drawings, in following areas:
         (a) Within aprons.
         (b) Within mowstrips.
         (c) Within sidewalks.
         (d) Within entryway slabs.
      4) Approved Products. See Section 01 6000:
         (a) Dow Corning:
            (1) Primer: 1200 Prime Coat.
            (2) Sealant: 890-SL Silicone Building Sealant.
         (b) Sika:
            (1) Primer: Primer: Sikasil Primer-2100.
            (2) Sealant: Sikasil-728 SL Self-leveling Silicone Sealant.
7. Sealants At Exterior Concrete Waterways - Flat Drainage Structures (Waterways:
   a. Expansion Joints and Control Joints:
      1) Description:
         (a) One component (part) self-leveling silicon material that cures to ultra-low modulus silicone rubber upon exposure to atmospheric moisture.
         (b) Cured silicone rubber remains flexible over entire temperature range expected in pavement applications.
      2) Design Criteria:
         (a) Sealant is required at following areas:
            (1) Within flat drainage structures and at joints between flat drainage structures and other concrete elements.
         (b) Meet following standards for Sealant: Self-leveling: ASTM D-5893; ASTM C920, Type S, Grade P, Class 100/50; Use T, M, G, A, O.
      3) Approved Products. See Section 01 6200:
         (a) Dow Corning:
            (1) Primer: 1200 Prime Coat.
            (2) Sealant: 890-SL Silicone Building Sealant.
         (b) Sika:
            (1) Primer: Primer: Sikasil Primer-2100.

(2) Sealant: Sikasil-728 SL Self-leveling Silicone Sealant.

8. Sealants At Curbs And Gutters:
   a. Expansion Joints and Control Joints:
      1) Description:
         (a) Effective for sealing transverse contraction and expansion joints, longitudinal, center line and shoulder joints in Portland cement concrete.
         (b) One component (part) non-sag silicone material that cures to low modulus, silicone rubber upon exposure to atmospheric moisture. May be applied over wide temperature range.
      2) Design Criteria:
         (a) Expansion joint sealant is required in following areas:
            (1) Within curbs and gutters at approved layout locations.
         (b) Meet following standards for Sealant: Non-sag: ASTM C920: Type S, Grade NS, Class 100/50, Use T, NT.
      3) Approved Products. See Section 01 6000:
         (a) Dow Corning:
            (1) Primer: 1200 Prime Coat.
            (2) Sealant: 888 Silicone Joint Sealant.
         (b) Sika:
            (1) Primer: Primer: Sikasil Primer-2100.
            (2) Sikasil-728 NS Non-Sag Silicone Sealant.
9. Sealants At Concrete Paving:
   a. Expansion Joints and Control Joints (as required in Section 32 1313):
      1) Description:
         (a) One component (part) self-leveling silicon material that cures to ultra-low modulus silicone rubber upon exposure to atmospheric moisture.
         (b) Cured silicone rubber remains flexible over entire temperature range expected in pavement applications.
      2) Design Criteria:
         (a) Sealant is required at approved layout locations.
         (b) Meet following standards for Sealant: Self-leveling: ASTM C920, Type S, Grade P, Class 100/50; Use T.
      3) Approved Products. See Section 01 6000:
         (a) Dow Corning:
            (1) Primer: 1200 Prime Coat.
            (2) Sealant: 890-SL Silicone Building Sealant.
         (b) Sika:
            (1) Primer: Primer: Sikasil Primer-2100.
            (2) Sealant: Sikasil-728 SL Self-leveling Silicone Sealant.
10. Sealants At Precast Concrete Cap and Joint Covers (if Contractor Option ONE was selected in Section 03 4500):
   a. Description:
      1) Soft lead strip, when set and bedded in sealant, form cap which assures permanent elastic seal for any masonry joint as specified in Section 03 4500.
   b. Design Criteria:
      1) Meet following standards for Sealant:
         (a) ASTM C920: Type S, Grade NS, Class 50 Use A, G, M.
         (b) Strips should be of sufficient size to cover the joint width, plus percentage allowance for anticipated joint movement, plus 1/4 inch (6.4 mm).

c. Approved Products. See Section 01 6000:
    1) Dow Corning:
        (a) Primer: 1200 Prime Coat.
        (b) Sealant: 791 Silicone Weatherproofing Sealant.
    2) Momentive Performance Materials (formerly, GE Sealants & Adhesives):
        (a) Primer: SS4044 Primer.
        (b) Sealant: GE SCS2000 SilPruf Silicone Sealant & Adhesive.
    3) Sika:
        (a) Primer: Sikasil Primer-2100.
        (b) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.
    4) Tremco:
        (a) Primer:
            (1) Metal surface: No. 20 primer.
            (2) Porous surfaces: No. 23 primer.
        (b) Sealant: Spectrum 1 Silicone Sealant.

11. General Interior Sealants:
    a. General:
        1) Inside jambs and heads of exterior door frames.
        2) Both sides of interior door frames.
        3) Inside perimeters of windows.
        4) Miscellaneous gaps between substrates.
    b. Design Criteria:
        1) Meet ASTM C920, Type S, Grade NS, NT, and Class 25 test requirements.
        2) 100 percent silicone sealant.
    c. VOC Content of Interior Sealants:
        1) Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
            (a) Architectural Sealants: 250 g/L.
            (b) Sealant Primers for Nonporous Substrates: 250 g/L.
            (c) Sealant Primers for Porous Substrates: 775 g/L.
    d. Non-Paintable Sealant (Installer Option A):
        1) Approved Product. See Section 01 6000:
            (a) Dow Corning: Tub, Tile, And Ceramic Silicone Sealant.
            (b) Laticrete: Latasil Silicone Sealant.
            (c) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS2800 SilGlaze II Silicone Sealant.
            (d) Sherwin Williams: White Lightning Silicone Ultra Low Odor Window and Door Sealant.
            (e) Tremco: Tremsil 200 Silicone Sealant.
            (f) Franklin International: Titebond 2601 (White) 2611 (Clear) 100% Silicone Sealant.
    e. Paintable Sealant (Installer Option B):
        1) Approved Product. See Section 01 6000:
            (a) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS7000 Paintable Silicone Sealant.

12. Sealants For Interior Joints:
    a. General:

1) Countertops and backsplash to wall.
2) Sinks and lavatories to countertops.
3) Joints between plumbing fixtures and other substrates.

b. Interior Ceramic Tile Joints are furnished in Section 07 9200 and installed in Section 09 3000 - Tiling including the following:
1) Ceramic tile inside corners.
2) Ceramic tile and paver tile joints.
3) Termination joints in font.
4) Termination joints in showers and font.

c. Description:
1) One-part acetoxy cure silicone sealant with fungicides to resist mold and mildew.

d. Design Criteria:
1) Meet ASTM C920, Type S, Grade NS, NT, and Class 25 test requirements.
2) 100 percent silicone sealant.

e. VOC Content of Interior Sealants:
1) Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
(a) Architectural Sealants: 250 g/L.
(b) Sealant Primers for Nonporous Substrates: 250 g/L.
(c) Sealant Primers for Porous Substrates: 775 g/L.

f. Color: As selected by Architect from Manufacturer's standard colors.

g. Approved Products. See Section 01 6000:
1) Dow Corning: Tub, Tile, And Ceramic Silicone Sealant.
2) Laticrete: Latasil Tile and Stone Silicone Sealant.
3) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS1700 Sanitary Silicone Sealant.
4) Tremco: Tremsil 200 Silicone Sealant.

C. Acoustical Joint Sealants:
1. Design Criteria:
a. Meet requirements of ASTM C834.
b. Meet Class A flame spread rating.
2. Approved Products. See Section 01 6000:
a. OSI Pro-Series SC-175 Draft & Acoustical Sound Sealant by OSI Sealants Inc, Mentor, OH www.osisealants.com.
b. QuietZone Acoustic Caulk by Owens Corning, Toledo, OH www.owenscorning.com.
c. Acoustical Sealant by Tremco, Beachwood, OH www.tremcosealants.com or Toronto, ON (800) 363-3213.
d. Acoustical Sound Sealant by Titebond.
e. Acoustical Sealant by U S Gypsum, Chicago, IL www.usg.com.

## 2.02 ACCESSORIES

A. Bond Breaker Tape:
1. Pressure sensitive tape as by Sealant Manufacturer to suit application.
2. Provide tape to prevent adhesion to joint fillers or joint surfaces at back of joint and allow sealant movement.

B. Joint Backing:

1. Comply with ASTM C1330.
2. Flexible closed cell, non-gassing polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.
3. Oversized 25 to 50 percent larger than joint width.

C. Joint Cleaner:
1. Non-corrosive and non-staining type as recommended by Sealant Manufacturer, compatible with joint forming materials.

D. Masking Tape:
1. Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verification Of Conditions:
1. Examine substrate surfaces and joint openings are ready to receive Work.
   a. Verify each sealant is compatible for use with joint substrates.
   b. Verify joint surfaces are clean and dry.
   c. Ensure concrete surfaces are fully cured.
2. Sealants provided shall meet Manufacturer's shelf-life requirements.
3. Notify Architect of unsuitable conditions in writing.
   a. Do not proceed until unsatisfactory conditions are corrected.
4. Commencement of Work by installer is considered acceptance of substrate.

### 3.02 PREPARATION

A. Surface Preparation:
1. Surfaces shall be clean, dry, free of dust, oil, grease, dew, frost or incompatible sealers, paints or coatings that may interfere with adhesion. Prepare substrates in accordance with Manufacturer’s instructions:
   a. Porous surfaces: Clean by mechanical methods to expose sound surface free of contamination and laitance followed by blasting with oil-free compressed air.
   b. Nonporous surfaces: Use two-cloth solvent wipe in accordance with ASTM C1193. Allow solvent to evaporate prior to sealant application.
   c. High-pressure water cleaning: Exercise care that water does not enter through failed joints.
   d. Primers:
      1) Primers enhance adhesion ability.
      2) Use of primers is not a substitution for poor joint preparation.
      3) Primers should be used always in horizontal application where there is ponding water.
2. Field test joints in inconspicuous location.
   a. Verify joint preparation and primer required to obtain optimum adhesion of sealants to joint substrate.
   b. When test indicates sealant adhesion failure, modify joint preparation primer, or both and retest until joint passes sealant adhesion test.
3. Masking: Apply masking tape as required to protect adjacent surfaces and to ensure straight bead line and facilitate cleaning.

B. Joints:
1. Prepare joints in accordance with ASTM C1193.

a. Clean joint surfaces of contaminates capable of affecting sealant bond to joint surface using Manufacturer's recommended instructions for joint preparation methods.
b. Remove dirt, dust, oils, wax, paints, and contamination capable of affecting primer and sealant bond.
c. Clean concrete joint surfaces to remove curing agents and form release agents.

C. Protection:
1. Protect elements surrounding the Work of this section from damage or disfiguration.

**3.03 APPLICATION**

A. General:
1. Apply silicone sealant in accordance with Manufacturer's instructions.
2. Do not use damaged or deteriorated materials.
3. Install primer and sealants in accordance with ASTM C1193 and Manufacturer's instructions.
4. Apply primer where required for sealant adhesion.
5. Install sealants immediately after joint preparation.
6. Do not use silicone sealant as per the following:
a. Apply caulking/sealant at temperatures below 40 deg F (4 deg C).
b. Below-grade applications.
c. Brass and copper surfaces.
d. Materials bleeding oils, plasticizers, and solvents.
e. Structural glazing and adhesive.
f. Surfaces to be immersed in water for prolonged time.

B. Joint Backing:
1. Install joint backing to maintain sealant joint ratios recommended by Manufacturer.
2. Install without gaps, twisting, stretching, or puncturing backing material. Use gage to ensure uniform depth to achieve correct profile, coverage, and performance.
3. Rod for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than 3/8 inch (9.5 mm) deep.

C. Bond Breaker:
1. Install bond breaker where joint backing is not used or where backing is not feasible.
a. Apply bond-breaker tape in shallow joints as recommended by Sealant Manufacturer.

D. Sealant:
1. Apply sealant with hand-caulking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Apply sealants in vertical joints from bottom to top.
2. Fill joint opening to full and proper configuration.
3. Apply in continuous operation.
4. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface. Tool joints in opposite direction from application direction, i.e., in vertical joints, from the top down. Do not 'wet tool' sealants.
5. Depth of sealant bite shall be 1/4 inch (6 mm) minimum and 1/2 inch (12.7 mm) maximum, but never more than one half or less than one fourth joint width.

E. Install at perimeter joints and mechanical and electrical penetrations in sound insulated rooms. Apply sealant with hand-caulking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint.

F. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface.

G. Caulk gaps between painted or coated substrates and unfinished or pre-finished substrates. Caulk gaps larger than 3/16 inch (5 mm) between painted or coated substrates.

## 3.04 TOLERANCES

A. Provide joint tolerances in accordance with Manufacturer's printed instructions.

## 3.05 FIELD QUALITY CONTROL

A. Inspection:
   1. Examine sealant joints to verify compliance with Contract Document requirements.

B. Non-Conforming Work. Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Sealant material found to be contaminated or damaged or inadequate preparation of substrate results in deficiencies in joint sealant adhesion is considered defective or not complying with Contract Document requirements.
   2. Correct any work found defective or not-complying with Contract Document requirements at no additional cost to Owner.

C. Adhesion Test (Installer Option to use adhesion test to determine if primer is required).
   1. Perform adhesion tests in accordance with Manufacturer's instructions and ASTM C1193, Method A, Field-Applied Sealant joint Hand-Pull Tab:
      a. Perform five (5) tests for first 1,000 linear feet (300 meters) of applied silicone sealant and one (1) test for each 1,000 linear feet (300 meters) seal thereafter or perform one (1) test per floor per building elevation minimum.
      b. For sealants applied between dissimilar materials, test both sides of joints.
   2. Sealants failing adhesion test shall be removed, substrates cleaned, sealants re-installed, and re-testing performed.
   3. Maintain test log and submit report to Architect indicating tests, locations, dates, results, and remedial actions.

## 3.06 CLEANING

A. Remove sealant from adjacent surfaces in accordance with Sealant Manufacturer and Substrate Manufacturer recommendations as work progresses.

B. Remove masking tape and excess sealant.

C. Clean adjacent materials, which have been soiled, immediately (before setting) as recommended by Manufacturer.

D. Waste Management: Dispose of products in accordance with manufacturer's recommendation.

**END OF SECTION**

**SECTION 08 0671**
**HARDWARE GROUP AND KEYING SCHEDULES**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install door hardware and keying as described in Contract Documents.

### 1.02 REFERENCES

A. Definitions:
   1. Builders Hardware Manufacturer's Association (BHMA) Hardware Functions:
      a. F75 Passage Latch: Latch bolt operated by lever from either side at all times.
      b. F76 Privacy Lock: Latch bolt operated by lever from either side. Outside lever locked by push button inside and unlocked by emergency key from outside or rotating lever from inside.
      c. F84 Classroom Deadlock: Dead locking latch bolt operated by lever from either side, except when outside lever is locked, latch bolt is operated by key in outside lever or by rotating inside lever.
      d. F86 Utility Space Door Lock: Dead locking latch bolt operated by key in outside lever or by rotating inside lever. Outside lever is always fixed.
      e. F91 Store Door Lock: Deadlocking latch operated by either lever. Key in either lever locks / unlocks both levers.
      f. F109 Entrance Lock: Turn/push button locking: Pushing and turning button disengages outside lever, requiring using of key until button is manually unlocked. Push-button locking: Pushing button disengages outside lever until unlocked by key or by turning inside lever. Disengages outside spindle from latch when locked.
      g. E2142 Deadbolt: Dead bolt operated by key from either side. Bolt automatically dead locks when fully thrown.
      h. E2152 Deadbolt: Dead bolt operated by key from outside and turn unit from inside. Bolt automatically dead locks when fully thrown.

### 1.03 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

## PART 2 HARDWARE GROUPS

### 2.01 STOREFRONT ENTRY DOORS

A. Group ST1:
   1. 1 set: Pivots.
   2. 1 set: Weatherstrip.
   3. 1 each: Closer.
   4. 1 each: Exit Door Exit Device with 154 stabilizers.
   5. 1 each: Exit Device with dogging capability and locking cylinder.
   6. 1 each: Pull.
   7. 1 each: Stop.

B. Group ST1A:
   1. 1 set: Pivots.
   2. 1 set: Weatherstrip.

3. 1 each: Closer.
4. 1 each: Exit Door Exit Device with 154 stabilizers.
5. 1 each: Kick Plate.
6. 1 each: Low-Energy Swing Door Operator.
7. 1 each: Pull.
8. 1 each: Stop.

C. Group ST2:
1. 1 set: Pivots.
2. 1 set: Weatherstrip.
3. 1 each: Closer.
4. 1 each: Exit Device with dogging capability with 154 stabilizers.
5. 1 each: Kick Plate.
6. 1 each: Pull.
7. 1 each: Stop.

D. Group ST3:
1. 1 set: Pivots.
2. 1 set: Weatherstrip.
3. 1 each: Closer.
4. 1 each: Kick Plate.
5. 1 each: Pull.
6. 1 each: Push.
7. 1 each: Stop.

E. Group ST3A:
1. 1 set: Pivots.
2. 1 set: Weatherstrip.
3. 1 each: Closer.
4. 1 each: Kick Plate.
5. 1 each: Low-Energy Swing Door Operator.
6. 1 each: Pull.
7. 1 each: Push.
8. 1 each: Stop.
9. 1 each: Threshold.

**2.02 EXTERIOR DOORS**

A. Group 1:
1. 1 set: Weatherstrip.
2. 3 each: Hinges.
3. 1 each: Deadbolt, Function E2152.
4. 1 each: Lockset Function F86.
5. 1 each: Stop.

B. Group 3:
1. 1 set: Weatherstrip.
2. 1 each: Closer.
3. 1 each: lockset Function F86.

4. 3 each: Hinges.
5. 1 each: Stop.
6. 1 each: Threshold.

**2.03 INTERIOR DOORS**

A. Group 20A:
1. 1 set: Smoke Gaskets.
2. 3 each: Hinges.
3. 1 each: Latchset Function F75.
4. 1 each: Stop.

B. Group 22:
1. 1 set: Smoke Gaskets.
2. 3 each: Hinges.
3. 1 each: Lockset Function F86.

C. Group 23:
1. 1 set: Smoke Gaskets.
2. 3 each: Hinges.
3. 1 each: Lockset Function F86.
4. 1 each: Stop.

D. Group 26:
1. 1 set: Smoke Gaskets.
2. 1 each: Acoustic Seal.
3. 3 each: Hinges.
4. 1 each: Lockset Function F109.
5. 1 each: Stop.

E. Group 28:
1. 1 set: Smoke Gaskets.
2. 1 each: Closer.
3. 3 each: Hinges.
4. 1 each: Kick Plate.
5. 1 each: Pull.
6. 1 each: Push.

F. Group 28A:
1. 1 set: Smoke Gaskets.
2. 1 each: Acoustic Seal.
3. 1 each: Closer.
4. 3 each: Hinges.
5. 1 each: Latchset, Function F75.
6. 1 each: Stop.

G. Group 30:
1. 1 set: Smoke Gaskets.
2. 1 each: Closer with hold open function.
3. 3 each: Hinges.
4. 1 each: Kick Plate.

5. 1 each: Pull.
6. 1 each: Push.

H. Group 32:
1. 1 set: Smoke Gaskets.
2. 1 each: Closer.
3. 3 each: Hinges.
4. 1 each: Lockset, Function F76.

I. Group 35:
1. 1 set: Smoke Gaskets.
2. 1 each: Closer.
3. 1 each: Deadbolt Function E2152.
4. 3 each: Hinges.
5. 1 each: Pull.
6. 1 each: Push.

J. Group 50:
1. General:
    a. 1 set: Smoke Gaskets.
2. Active Leaf:
    a. 3 each: Hinges.
    b. 1 each: Lockset Function F109.
    c. 1 each: Stop.
3. Inactive Leaf:
    a. 2 each: Flush Bolts.
    b. 3 each: Hinges.

K. Group 50F:
1. General:
    a. 1 set: Smoke Gaskets.
2. Active Leaf:
    a. 1 each: Deadbolt, Function E2152.
    b. 3 each: Hinges.
    c. 1 each: Stop.
3. Inactive Leaf:
    a. 1 each: Astragal (font side of door).
    b. 1 each: Dummy Latchset, (pull side only).
    c. 1 each: Flush Bolt (top).

L. Group 51:
1. General:
    a. 1 set: Smoke Gaskets.
2. Active Leaf:
    a. 3 each: Hinges.
    b. 1 each: Lockset Function F86.
    c. 1 each: Stop.
3. Inactive Leaf:

a. 1 each: Flush Bolt.
b. 3 each: Hinges.

M. Group 52:
1. General:
a. 1 set: Smoke Gaskets.
2. Active Leaf:
a. 1 each: Closer with hold open function.
b. 3 each: Hinges.
c. 1 each: Pull.
d. 1 each: Push.
e. 1 each: Kick Plate.
f. 1 each: Stop.
3. Inactive Leaf:
a. 1 each: Closer with hold open function.
b. 3 each: Hinges.
c. 1 each: Kick Plate.
d. 1 each: Pull.
e. 1 each: Push.
f. 1 each: Stop.

## PART 3 KEYING SCHEDULE FOR FINISH HARDWARE

### 3.01 KEYING SCHEDULE

A. Stake Center Meetinghouse Keying Schedule:
1. General access Storage Rooms and Font (Font Dressing Rooms if included):

| Key | Stamped | Amount | Door Numbers of Doors Operated by Key |
|---|---|---|---|
| XAA1 | GEN | 45 | |

2. Bishop's Offices:

| Key | Stamped | Amount | Doors Operated by Key |
|---|---|---|---|
| AA2 | BP 1 | 5 | Key AA2 will also open XAA1, XAA6, XAA14, XAA 16, and XAA17. |
| AA3 | BP 2 | 5 | Key AA3 will also open XAA1, XAA7, XAA14, XAA 16, and XAA17. |
| AA4 | BP 3 | 5 | Key AA4 will also open XAA1, XAA8, XAA14, XAA 16, and XAA17. |
| AA5 | BP 4 | 5 | Key AA5 will also open XAA1, XAA9, |

| | | | |
|---|---|---|---|
| | | | XAA14, XAA 16, and XAA17. |

3. Clerk's Offices:

| Key | Stamped | Amount | Doors Operated by Key |
|---|---|---|---|
| XAA6 | CLK 1 | 3 | Key AA6 will also open XAA1. |
| XAA7 | CLK 2 | 3 | Key AA7 will also open XAA1. |
| XAA8 | CLK 3 | 3 | Key AA8 will also open XAA1. |
| XAA9 | CLK 4 | 3 | Key AA9 will also open XAA1. |

4. Auxiliary Organization Storage Spaces (Storage Building):

| Key | Stamped | Amount | Doors Operated by Key |
|---|---|---|---|
| AA10 | AUX 1 | 18 | Key AA10 will also open XAA1. |
| AA11 | AUX 2 | 2 | Key AA11 will also open XAA1. |
| AA12 | AUX 3 | 2 | Key AA12 will also open XAA1. |
| AA13 | AUX 4 | 2 | Key AA13 will also open XAA1. |

5. Material Center:

| Key | Stamped | Amount | Doors Operated by Key |
|---|---|---|---|
| XAA14 | MTL CTR | 12 | Key AA14 will also open XAA1. |

6. Mechanical And Utility Rooms:

| Key | Stamped | Amount | |
|---|---|---|---|
| XAA15 | MECH | 2 | |

7. Technology Room:

| Key | Stamped | Amount | |
|---|---|---|---|
| XAA16 | TECH | 5 | |

8. Sports Closet:

| Key | Stamped | Amount | |
|---|---|---|---|
| XAA17 | S C | 5 | |

9. Stake President's Office:

| Key | Stamped | Amount | Doors Operated by Key |
|---|---|---|---|
| AA18 | STK PR | 5 | Key AA18 will also open XAA1, XAA14, |

| | | | |
|---|---|---|---|
| | | | XAA16, XAA17, and XAA19. |

10. Remaining Stake Suite Doors (excluding Exterior Door):

| Key | Stamped | Amount | Doors Operated by Key |
|---|---|---|---|
| XAA19 | STK | 20 | Key AA17 will also open XAA1. |

**END OF SECTION 08 0671**

## SECTION 08 1113
## 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.

E. Sound-rated hollow metal doors and frames.

F. Commercial security hollow metal doors and frames.

G. Accessories, including glazing, louvers, and matching panels.

### 1.02 DEFINITIONS

A. Fire-rated: Fire-retardant particleboard with an Underwriters' Laboratory (UL) stamp for Class 1 fire rating (Flame Spread 20, Smoke Developed 25). Fire-rated doors are available with particleboard and mineral cores for ratings up to 1-1/2 hours.

B. Fire-rated Door: A door made of fire-resistant material that can be closed to prevent the spread of fire and can be rated as resisting fire for 20 minutes (1/3 hour), 30 minutes (1/2 hour), 45 minutes (3/4 hour) (C), 1 hour (B), or 1-1/2 hours (B). The door must be tested and carry an identifying label from a qualified testing and inspection agency.

### 1.03 REFERENCE STANDARDS

A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.

B. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2020.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.

E. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames 2022.

F. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low- Alloy, Hot-Rolled and Cold-Rolled, General Requirements for 2019a.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

H. ASTM C1036 - Standard Specification for Flat Glass 2021.

I. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

K. NAAMM HMMA 810 - Hollow Metal Doors 2009.

L. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.

M. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames 2018.

N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.

R. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

B. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

C. Copy of SDI A250.11.

### 1.05 QUALITY ASSURANCE

A. Maintain at project site copies of reference standards relating to installation of products specified.

B. Pre-Installation Conference.
   1. Participate in pre-installation conference.
   2. In addition to agenda items specified in Section 01 3100, review following:
      a. Schedule conference after hardware has been delivered to site and organized into hardware groups by door, but before installation of hardware.
      b. Check for appropriate blocking and for correct hardware models and fasteners for substrates.
      c. Review submittals and set of Manufacturer's installation, adjustment, and maintenance instructions submitted under Section 08 7101.
      d. Review use of crowbar or other prying devices are not permitted to be used to set door frame into wall opening.

### 1.06 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 SUPPLIERS

A. Architectural Building Supply, Salt Lake City, UT www.cookandboardman.com:
   1. Contact Information: Russ Farley: phone (800) 574-4369, fax 801-484-6817, or e-mail russf@absdoors.com.

B. Beacon Metals Inc, Salt Lake City, UT www.beacon-metals.com:
   1. Contact Information: Jared Butler: phone (801) 486-4884, cell (435) 216-2297, FAX 801-485-7647, or e-mail Jared@beacon-metals.com.

C. Midwest D-Vision Solutions, Salt Lake City, UT www.mwdsutah.com.
   1. Contact Information: Dan Mercer, office (801) 377-4355, cell (801) 618-9456, e-mail danm@mwdsutah.com.

## 2.02 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Any current member of Steel Door Institute.

## 2.03 PERFORMANCE REQUIREMENTS

A. 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.

## 2.04 HOLLOW METAL DOORS

A. Doors:
   1. Meet one of following requirements:
      a. Meet requirements of Steel Door Institute ANSI / SDI A250.8.
      b. Commercial grade steel meeting requirements of ASTM A568/A568M, Class 1:
         1) Grade II for interior doors, Grade III for exterior doors.
         2) Model 1 Full Flush or Model 2 Seamless designs at Manufacturer's option.
         3) Type F and G as required.
         4) Finish:
            (a) Interior doors primed or galvanized as per ASTM A653/A653M.
            (b) Exterior doors galvanized and primed as per ASTM A653/A653M.

B. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush or 2 - Seamless.
      d. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Door Core Material: Polystyrene 1 lbs/cu ft minimum density.
      a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
   3. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
   4. Door Face Sheets: Flush.
   5. Door Finish: Factory primed and field finished.

C. Interior Doors, Non-Fire-Rated:
   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. Model 1 - Full Flush.

D. Interior 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. Model 1 - Full Flush.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inches, nominal.
5. Door Finish: Factory primed and field finished.

E. Fabrication:
1. General:
a. Mortise and reinforce doors for hinges and locks.
b. Reinforce doors for closers and other surface applied hardware.
c. Drill and tap on job.
d. Seams along vertical edges of door need not be filled.
e. Do not extend hinge cut out full width of door unless fill strip is inserted, weld filled, and ground smooth so no seam appears on back face plate.
f. Double doors shall have overlapping rolled steel astragal.
g. Fire Doors:
1) Fire-rated doors shall be provided for those openings requiring fire protection and temperature rise ratings, as determined and scheduled by Architect.
2) Construct UL fire doors and frames to meet UL's specific approval according to current procedure for door rating involved, Procedure No. R-3791 and R-3821 as listed by UL.
(a) Labeling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and shall identify Manufacturer.

## 2.05 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. Cold rolled furniture steel
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
3. Frame Finish: Factory primed and field finished.
4. Provide labeled frame to match fire rating of door.
5. Anchors: 16 US ga (1.6 mm) minimum meeting UL or other code acceptable requirements for door rating involved.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type. Cold rolled furniture steel
1. Prime surfaces with rust inhibiting primer.

2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
3. Frame Finish: Factory primed and field finished.
4. Provide labeled frame to match fire rating of door.
5. Anchors: 16 US ga (1.6 mm) minimum meeting UL or other code acceptable requirements for door rating involved.

D. Door Frames, Fire-Rated: Full profile/continuously welded type. Cold rolled furniture steel
   1. Fire Rating: Same as door, labeled.

E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

F. Mullions for Pairs of Doors: Fixed, with profile similar to jambs.

G. Transom Bars: Fixed, of profile same as jamb and head.

H. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

I. Fabrication:
   1. General Requirements:
      a. Provide temporary spreader on each welded frame.
      b. Provide Manufacturer's gauge label for each item.
      c. Make breaks, arrises, and angles uniform, straight, and true. Accurately fit corners.
   2. Frame width dimension:
      a. Fabricate frame 1/8 inch wider than finished wall thickness as described in Contract Documents.
   3. Provide mortar guards at strikes and hinges.
   4. Anchors:
      a. Provide three jamb anchors minimum for each jamb. On hinge side, install one anchor at each hinge location. On strike side, install one anchor at strike level and anchors at same level as top and bottom hinges. Tack weld anchors on frames intended for installation in framed walls.
      b. Frames installed before walls are constructed shall be provided with extended base anchors in addition to other specified anchors.
      c. Anchor types and configurations shall meet wall conditions.

## 2.06 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.07 ACCESSORIES

A. Factory Glazing at Non-Rated Openings Narrow Light: Clear sheet glass, tempered glazing meeting requirements of ASTM C1048, Kind FT, Condition A, Type I, Class I, Quality Q3, 1/4-inch thick, factory installed.

B. Glazing at fire-rated openings: Factory installed fire rated glazing which allows door to maintain rating indicated with size of lite indicated. Thickness: 1/4 (6mm).

## 2.08 SOURCE QUALITY CONTROL

A. Tests:
    1. Verification of Performance:
        a. Label each door as conforming to above required standards.

## 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 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### 3.03 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 prefinished frames after painting and wall finishes are complete.

C. Install fire rated units in accordance with NFPA 80.

D. Coordinate frame anchor placement with wall construction.

E. Set frame in location and level head.
    1. Use of crowbar or other prying device to set door frame into wall opening will damage door frames and are not permitted to be used.

F. Equalize with adjustable floor anchor.

G. Set spreaders and fasten jambs to floor and wall.
    1. Wood spreaders shall be square, fabricated from lumber one inch minimum thick, be same length as door opening at header, and same depth as frame.
    2. Cut notches for frame stops.
    3. Do not remove spreaders until frames are permanently anchored in wall.
    4. Use one spreader at base of frame and another at strike level.
    5. Do not use temporary spreaders welded to base of jambs during installation of frame.

H. Fill gap between frame and framing with urethane foam or tightly-packed fiberglass insulation. If urethane foam is used, foam interior of frames before installing frame. Trim excess before installation of frame.

I. Caulking:
    1. Caulk around both sides of frames of doors receiving acoustical seals with specified sealant.
    2. Caulk around both sides of frames installed in exposed masonry walls with specified sealant.

J. Install door hardware as specified in Section 08 7100.
    1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

K. Comply with glazing installation requirements of Section 08 8000.

L. Coordinate installation of electrical connections to electrical hardware items.

M. Touch up damaged factory finishes.

**3.04 TOLERANCES**

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

C. Site Tolerances:
   1. Squareness: 1/16 inch from top edge to opposite top edge.
   2. Plumbness: 1/16 inch from top of jamb to bottom of jamb.
   3. Alignment: 1/16 inch from plane of left side face of jamb to right side face of jamb.
   4. Twist: 1/16 inch across throat of jamb plane measured across each face to plane of opposite jamb throat.
   5. Finished Clearance Between Door And Frame:
      a. 1/16 inch at head and hinge jamb plus 1/16 inch maximum 2) 1/8 inch at strike jamb plus or minus 1/16 inch maximum.
      b. 1/2 inch to top of finished floor surface or 1/4 inch to top of threshold, plus or minus 1/16 inch maximum.

**3.05 ADJUSTING**

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

D. When Project is completed, doors shall not bind, stick, or be mounted so as to cause future hardware difficulties.

E. Do not impair utility or structural strength of door in fitting of door, applying hardware, or cutting and altering door louvers, panels, or other special details.

**3.06 FIELD QUALITY CONTROL**

A. Field Tests:
   1. Arrange to have keys brought to Project site and, in meeting attended by local representatives and Architect, test every new key and locking mechanism.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.
   2. Door frames:
      a. Door frames damaged by use of crowbar or other prying devices to set door frames shall be repaired or replaced at no additional cost to Owner.

**3.07 CLOSEOUT ACTIVITIES**

A. Instruction of Owner:
   1. Using Owner's Operations And Maintenance Manual, explain keying systems at same time keys and locking mechanisms are tested.

B. Key Delivery:
   1. Immediately before Final Acceptance Meeting, turn change keys over to Owner properly organized, tagged, and placed in new or existing key cabinet.

**3.08 SCHEDULE**

A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION**

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**SECTION 08 1416**
**FLUSH WOOD DOORS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, and acoustical.

### 1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood door frames.

B. Section 08 1113 - Hollow Metal Doors and Frames.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing.

### 1.03 REFERENCE STANDARDS

A. References

B. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2017.

C. ASTM C1036 - Standard Specification for Flat Glass 2021.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

F. CPA (Composit Panel Association) - Standard Publications 2016.

G. CPSC (Consumer Products Safety Commission - Safety Standard for Architectural Glazing Materials 16 CFR, Part 1201 CAT 1 and 11.

H. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

I. NFPA 101-2018 - Life Safety Code 2018.

J. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

K. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.

L. UL 9 - Standard for Fire Tests of Window Assemblies Current Edition, Including All Revisions.

M. **Definitions**

1. Book-Match: Matching between adjacent veneer leaves on one panel face. Every other piece of veneer is turned over so that the adjacent leaves are “opened” as two pages in a book. The fibers of the wood, slanting in opposite directions in the adjacent leaves, create a characteristic light and dark effect when the surface is seen from an angle.
2. Fire-rated: Fire-retardant particleboard with an Underwriters’ Laboratory (UL) stamp for Class 1 fire rating (Flame Spread 20, Smoke Developed 25). Fire-rated doors are available with particleboard and mineral cores for ratings up to 1-1/2 hours.
3. Fire-rated Door: A door made of fire-resistant material that can be closed to prevent the spread of fire and can be rated as resisting fire for 20 minutes (1/3 hour), 30 minutes (1/2 hour), 45 minutes (3/4 hour) (C), 1 hour (B), or 1-1/2 hours (B). The door must be tested and carry an identifying label from a qualified testing and inspection agency.
4. Grade: Unless otherwise noted, this term means Grade rules for Economy, Custom, and/or Premium Grade.

a. Custom Grade: Typically specified for and adequately covers most high-quality architectural woodwork, providing a well-defined degree of control over a project's quality of materials, workmanship, or installation.
b. Premium Grade: The highest Grade available in both material and workmanship where the highest level of quality, materials, workmanship, and installation is required.

5. Running Match: Each panel face is assembled from as many veneer leaves as necessary. Any portion left over from one panel may be used to start the next.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference.
1. Participate in pre-installation conference.
2. In addition to agenda items specified in Section 01 3000, review following:
a. Schedule conference after hardware has been delivered to site and organized into hardware groups by door, but before installation of hardware.
b. Check for appropriate blocking and for correct hardware models and fasteners for substrates.
c. Review submittals and set of Manufacturer's installation, adjustment, and maintenance instructions submitted under Section 008 7100.
d. Review use of crowbar or other prying devices are not permitted to be used to set door frame into wall opening.

## 1.05 SUBMITTALS

A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

B. 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. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
2. Indicate factory finish color and type.

C. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

D. Samples:
1. Interior Hardwood for Transparent Finish:
a. Approval subject to Annual Review:
1) Prepare sample to match Control Sample available from Owner to be used as finishing standard for interior clear finished hardwood as specified in Section 09 9324.
2) Approval of sample by Owner will establish performance standard of stain to be used until next annual review.
b. Design Criteria:
1) Provide 8 inch by 10 inch (200 mm by 255 mm) sample of Red Oak to match stain Control Sample provided by Owner.

E. Manufacturer's Installation Instructions: Indicate special installation instructions.

F. Manufacturer's qualification statement.

G. Warranty executed in Owner's name.

H. Closeout Submittals:
   1. Include following information in Operations And Maintenance Manuals specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturers Documentation:
            (a) Manufacturer's product literature on doors and factory finish.
            (b) Maintenance and repair instructions.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A. Deliver in clean truck and, in wet weather, under cover.

B. Deliver to building site only after plaster, cement, and taping compound are completed and dry and after interior painting operations have been completed.

C. Individually wrap in polyethylene bags for shipment and storage.

D. Store doors in a space having controlled temperature and humidity range between 25 and 55 percent.

E. Accept doors on site in manufacturer's packaging and inspect for damage.

F. Store flat on a level surface in a dry, well ventilated building.

G. Cover to keep clean but allow air circulation.

H. Handle with clean gloves and do not drag doors across one another or across other surfaces.

I. Do not subject doors to abnormal heat, dryness, or humidity or sudden changes therein.

J. Condition doors to average prevailing humidity of locality before hanging.

**1.07 WARRANTY**

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
   1. Warranty shall include finishing, hanging, and installing hardware if manufacturing defect was discovered after door was finished and installed.
   2. Include coverage for delamination in any degree, warping or twisting of 1/4 inch or more in door panel at time of one-year warranty inspection, and telegraphing of core assembly: Variation of 1/100 inch or more in 3 inch span.

**PART 2 PRODUCTS**

**2.01 SUPPLIERS**

A. Architectural Building Supply, Salt Lake City, UT www.cookandboardman.com:
   1. Contact Information: Russ Farley: phone (800) 574-4369, fax 801-484-6817, or e-mail russf@absdoors.com.

B. Beacon Metals Inc, Salt Lake City, UT www.beacon-metals.com:
   1. Contact Information: Jared Butler: phone (801) 486-4884, cell (435) 216-2297, FAX 801-485-7647, or e-mail Jared@beacon-metals.com.

C. Midwest D-Vision Solutions, Salt Lake City, UT www.mwdsutah.com.
   1. Contact Information: Dan Mercer, office (801) 377-4355, cell (801) 618-9456, e-mail danm@mwdsutah.com.

**2.02 APPROVED MANUFACTURERS**

A. Wood Veneer Faced Doors:
   1. Graham Wood Doors, Mason City, IA.
   2. Marshfield Door Systems Inc, Marshfield, WI.
   3. VT Industries, Holstein, IA.

**2.03 DOORS**

A. Wood Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Type: AWS PC-5ME or FD-5ME.
   2. Grade: AWS Premium, except face veneer.
   3. Fully Type I Construction: Adhere all glue lines with Type I adhesive, including veneer lay-up.
   4. Face Veneer:
      a. Plain sliced Red Oak meeting requirements of AWS Grade A, 1/50 inch (0.5 mm) thick minimum immediately before finishing.
      b. Face veneers shall be running book matched.

B. Core:
   1. Fully bonded to stiles and rails and sanded as a unit before applying veneers.
   2. Non-Rated:
      a. 32 lb density meeting requirements of ANSI A208.1 Mat Formed Wood Particle Board, Grade 1-L-1 minimum.
      b. Stiles:
         1) 1-3/8 inches deep minimum before fitting.
         2) Stile face to be hardwood matching face veneer material, thickness manufacturer's standard.
      c. Rails:
         1) 1-1/8 inches
         2) Manufacturer's option.
   3. Fire-rated, AWS FD 1/3:
      a. 32 lb density meeting requirements of ANSI A208.1 Mat Formed Wood Particle Board, Grade 1-L-1 minimum.
      b. Stiles:
         1) 1-3/8 inches deep minimum before fitting.
         2) Stile face to be hardwood matching face veneer material, thickness manufacturer's standard.
      c. Rails:
         1) 1-1/8 inches
         2) Manufacturer's option.
   4. Fire-Rated, AWS FD 3/4, 1, and 1-1/2:
      a. Mineral as standard with approved Manufacturer with inner blocking, 5 inches (125 mm) wide minimum, for closers, flush bolts, and exit devices.
      b. Stiles And Rails:
         1) Sizes of stiles and rails to be Manufacturer's standard meeting fire rating, and incorporating solid hardwood stile face.
         2) Stiles for pairs of mineral core doors shall be of material and configuration meeting required fire rating without use of metal astragal or edge.

C. Glazing Configurations:
   1. Glazing (non-fire-rated openings): Tempered glazing meeting requirements of ASTM C1048, Kind FT, Condition A, Type I, Class I, Quality q3. Thickness 1/4 inch.
   2. Glazing (non-fire-rated and fire-rated openings): Wired glazing meeting requirements of ASTM C1036, Type II, Class I - Clear, Quality - q8 Glazing Select, Form I polished both sides, Mesh - m1 (diamond).
      a. Meet US Consumer Product Safety Commission safety rating (CPSC 16 CFR 1201).
      b. Thickness 1/4 inch
   3. Lite Kit:
      a. Design Criteria: Pre-finished wood or wood veneer frames.
   4. Dimensions:
      a. Meetinghouse Classroom Doors: 6 inch (150 mm) wide by 16 inches (400 mm) high clear opening) security view window with bottom of opening located 56 inches (1 420 mm) above finish floor and side located 6 inches (150 mm) from strike edge of door.
   5. Approved Product.
      a. Profile M6G by Graham.
      b. Profile W6 by Marshfield.
      c. Profile VT1 by VT Industries.

**2.04 DOOR CONSTRUCTION**

A. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other through bolted hardware.

B. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.

C. At exterior doors, provide aluminum flashing at the top and bottom rail and the sill of glazed openings for full thickness and width of door.

D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

G. Cut and configure exterior door edge to receive recessed weatherstripping devices.

H. Provide edge clearances in accordance with the quality standard specified.

**2.05 FINISHES - WOOD VENEER DOORS**

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. Applied by Door Manufacturer before leaving factory.
      b. Stain: To match control sample:
         1) OAK 95.

**2.06 SOURCE QUALITY CONTROL**

A. Inspections:
    1. Verification of Performance:
        a. Doors shall have following information permanently affixed on top of door:
            1) Manufacturer:
            2) Door designation or model.
            3) Veneer species.
            4) Factory finish.
    2. Clear Finished Hardwood:
        a. Color matches Owner provided sample in Section 09 9300.
        b. Conform to National Fire Protection Standards, NFPA 80, for fire-rated doors.
            1) Required fire-rated doors shall bear approved labels of UL, Warnock Hersey International, or other code acceptable agency.
            2) Machining for hardware shall be complete before application of label.

## PART 3 EXECUTION

### 3.01 CLOSEOUT ACTIVITIES

A. Instruction of Owner:
    1. Using Owner's Operations and Maintenance Manual, explain keying systems at same time keys and locking mechanisms are tested.

B. Key Delivery:
    1. Immediately before Final Acceptance Meeting, turn change keys over to Owner properly organized, tagged, and placed in new or existing key cabinet.

**END OF SECTION**

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## SECTION 08 3100
## ACCESS DOORS AND PANELS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Wall-mounted access units.

B. Ceiling-mounted access units.

C. Wall- and ceiling-mounted access units.

### 1.02 SUBMITTALS

A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

B. Shop Drawings: Indicate exact position of each access door and/or panel unit.

C. Manufacturer's Installation Instructions: Indicate installation requirements.

### PART 2 PRODUCTS

### 2.01 MANUFACTURED UNITS

A. Acceptable Manufacturers:
   1. Babcock-Davis, Minneapolis, MN www.babcock-davis.com.
   2. The Bilco Company, New Haven, CT www.bilco.com or Bilco Canada, London, ON (519) 659-7331.
   3. Dur-Red Products, Cudahy, CA www.dur-red.com.
   4. Elmdor Stoneman, City of Industry, CA www.elmdorstoneman.com.
   5. Jensen Industries, Los Angeles, CA www.jensen-ind.com.
   6. Karp Associates Inc, Maspeth, NY www.karpinc.com.
   7. Larsen's Manufacturing Co, Minneapolis, MN www.larsensmfg.com.
   8. Mifab Manufacturing Co, Minneapolis, MN www.mifab.com.
   9. Milcor, Bensenville, IL www.milcorinc.com.
   10. Nystrom Inc, Brooklyn Park, MN www.nystrom.com.
   11. Williams Brothers Corporation of America, Reno, NV www.wbdoors.com.
   12. Equal as approved by Architect before bidding. See Section 01 6200.

### 2.02 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall and Ceiling Mounted Units:
   1. Location: As indicated on drawings.
   2. Material: Steel; factory powder-coated prime finish.
   3. Door/Panel: Continuous piano hinged, standard duty, manually operated with single key-operated lock, interior latch release, and continuous piano hinge hardware.
   4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

B. Non-Fire-Rated Access panel, Class Two Quality Standards:
   1. Acoustical Tile: DSC-210 by Karp.
   2. Plaster: DSC-210 PL by Karp.
   3. Drywall: KDW or Sesame (KSTDW or KSTE) by Karp.
   4. Masonry: DSC-214M by Karp.

C. Non-Fire-Rated Insulated Door, Class Two Quality Standard:
   1. KRP-150 FR or KRP-350.FR by Karp.

D. Fire-rated, Class Two Quality Standard:
   1. Insulated: KRP-150 FR or KRP-350.FR by Karp.
   2. Non-Insulated: KRP-250FR or KRP-450FR by Karp.

E. Fire-Rated Upward Opening Access Doors:
   1. Install at head of wall-mounted ladders.
   2. Manually operated with 1/4 inch (6 mm) allen-head key-operated, self-closing latch and continuous piano hinge.
   3. Factory prime finish.
   4. Quality Standard:
      a. FRU by Nystrom Inc.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

**END OF SECTION**

## SECTION 08 4313
## ALUMINUM-FRAMED STOREFRONTS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

D. Door hardware.

### 1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

### 1.03 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. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

C. AAMA SFM-1 - Aluminum Storefront & Entrance Manual; Current.

D. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

E. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

F. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

G. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

J. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).

K. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

L. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2018, with Editorial Revision.

M. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

N. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

O. 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).

P. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials; 2019.

Q. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2020.

R. BHMA A156.19 - Power Assist and Low Energy Power Operated Swinging Doors; 2019.

S. ICC (IBC)-2018 - International Building Code; 2018.

T. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

U. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2020.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

C. Participate in MANDATORY pre-installation conference as specified in Section 06 1100.
   1. Schedule pre-installation conference one (1) week before scheduled installation of storefront system.
   2. In addition to requirements of Section 01 3000, review following:
      a. Review rough opening requirements:
         1) Make certain rough openings are within tolerances required for installation of factory-fabricated frames.
         2) These dimensions have been agreed upon between Owner and Manufacturer and are shown on Standard Plan Drawings.
      b. Review installation scheduling, coordination, placement of doors.
      c. Review low-energy door operator location and requirements.
      d. Review location of signage on entrance doors.
      e. Review delivery, storage, and handling requirements.
      f. Review safety issues.
      g. Review 'Finish' door and hardware requirements.
      h. Review 'Protection' responsibilities.
      i. Review 'Cleaning' responsibilities.

## 1.05 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details, color and finishes, storefront entry system and low-energy door operators.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
   1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
   2. Show exact dimensions of factory-fabricated frames and required tolerances for rough openings. Submit shop drawings in time for Pre-Installation Conference specified in Section 06 1100.
   3. Show locations, sizes, etc, of hardware reinforcing.

4. Show wind loads and engineering for Project conditions.
5. Clearly mark components to identify their location in Project.

C. Informational Submittals:
1. Qualification Statement:
a. Installer:
1) Provide Qualification documentation if requested by Architect or Owner.

D. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Operations and Maintenance Data:
1) Maintenance, adjustment, and repair instructions.
b. Warranty Documentation:
1) Final, executed copy of Warranty.
(a) Storefront warranty.
(b) Storefront closers.
(c) Low-energy door operator.
c. Record Documentation:
1) Manufacturers documentation:
(a) Manufacturer's literature or cut sheets for storefront system and for each item of hardware.
(b) Manufacturer’s literature of cut sheets for low-energy door operators.
(c) Color and finish selections.
(d) Parts lists.

**1.06 QUALITY ASSURANCE**

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
1. Provide aluminum entrances and storefront systems produced by firm experienced in manufacturing systems that are similar to those indicated for this project and have record of successful in-service performance.
2. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
a. Insulating Glass Certification Council (IGCC).
b. Safety Glazing Certification Council (SGCC).

B. Fabricator Qualifications:
1. Provide aluminum entrances and storefront systems fabricated by a firm experienced in producing systems that are similar to those indicated for this Project, and have record of successful in-service performance.
2. Fabricator shall have sufficient production capacity to produce components required without causing delay in progress of the Work.

C. Installer Qualifications:
1. Minimum three (3) years experience in storefront installations.
2. Minimum five (5) satisfactorily completed projects of comparable quality, similar size, and complexity in past three (3) years before bidding.
3. Upon request, submit documentation.

D. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
   1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
      a. North American Contractor Certification (NACC) for glazing contractors.
      b. Equivalent independent third-party ANSI accredited certification.

**1.07 DELIVERY, STORAGE, AND HANDLING**

A. Handle products of this section in accordance with AAMA CW-10.

B. Deliver all parts of door, together with hardware, in original, unopened packages with labels intact to Project at same time.

C. Store in clean, dry location, indoors in Manufacturer's unopened packaging until ready for installation and in accordance with Manufacturer's instructions.

D. Stack framing components in a manner that will prevent bending and avoid significant or permanent damage.

E. Protect materials and finish from damage during storage, handling and installation.

F. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

**1.08 FIELD CONDITIONS**

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

**1.09 WARRANTY**

A. Manufacturer Warranty:
   1. Storefront Entrances:
      a. Manufacturer's Warranty to be free of defects in material and workmanship.
      b. Manufacturer's Warranty against deterioration or fading.
      c. Manufacturer's Lifetime Warranty for Door Construction for normal use.
   2. Closers:
      a. Closer Manufacturer's standard warranty, 10 years minimum.
   3. Low-Energy Door Operator:
      a. Manufacturer's standard warranty.

B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

**PART 2 PRODUCTS**

**2.01 ASSEMBLIES**

A. Manufacturers:
   1. Oldcastle BuildingEnvelope: www.obe.com
      a. Contact information: Mark Lehman, cell: (651) 253-5062; email: mlehman@obe.com
   2. Arcadia Inc., Vernon CA www.arcadiainc.com.
      a. Contact Information: Ken Martinek, (602) 734-5327 kmartinek@arcadiainc.com

3. Kawneer North America, Norcross, GA, www.kawneer.com/kawneer/north_america.
    a. Contact Information: Bart Daniels cell (385) 214-4650; bart.daniels@alcoa.com

B. General:
1. In addition to requirements shown or specified, comply with:
    a. Applicable provisions of AAMA SFM 1, 'Aluminum Store Front and Entrance Manual' for design, materials, fabrication and installation of component parts.

C. Design Criteria:
1. Storefront System suitable for outside or inside glazing.

## 2.02 FRAMING COMPONENTS AND ACCESSORIES

A. Aluminum Extrusions:
1. 6063-T6 aluminum alloy or meet requirements of ASTM B221, alloy GS 10a T6.
2. Anchors, Clips, and Accessories:
    a. Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated (properly isolated steel from aluminum).
3. Fasteners:
    a. Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
4. Glazing Gasket:
    a. Compression-type design with replaceable extruded EPDM rubber.
5. Reinforcing Members:
    a. Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
    b. Mullion:
        1) Steel reinforced or heavy duty as necessary to prevent lateral flexing of mullion.
6. Sills:
    a. Match height of door bottoms.
7. Sealant:
    a. Structural Sealant meeting requirements of ASTM C1184 for fabrication within storefront system:
        1) Permanently elastic, non-shrinking, and non-migrating type for joint size and movement.
        2) Single-component neutral-curing silicone formulation compatible with system components specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in aluminum-framed systems indicated.
        3) Color: Black.
    b. Joint Sealants used at perimeter of storefront framing system: Elastomeric Sealant as specified in Section 07 9200.

c. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
d. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when required by local codes or AHJ.

8. Tolerances:
a. Tolerances for wall thickness and other cross-sectional dimensions of storefront members in compliance with AA Aluminum Standards and Data.

B. Storefront Framing System:
1. Brackets and Reinforcements:
a. Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
2. Fasteners and Accessories:
a. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
3. Perimeter Anchors:
a. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

C. Finish:
1. Match doors.

D. Approved Products See Section 01 6000 :
1. Non-Thermal, 2 inch (50 mm) Sightline:
a. Double Stack header at exterior doors only if shown on Contract Drawings.
b. Single Glazed:
1) FG3000 by Oldcastle BuildingEnvelope
2) AR450 by Arcadia
3) Trifab VG 450 by Kawneer
c. Double Glazed:
1) FG3000 MultiPlane by Oldcastle BuildingEnvelope
2) AG451 by Arcadia
3) Trifab VG 451 by Kawneer

E. Approved Products -HVHZ:
1. Non-Thermal:
a. Single Glazed:
1) FG-5700 StormMax by Oldcastle BuildingEnvelope
2) IP2550 by Arcadia
3) IR 500 by Kawneer
b. Double Glazed:
1) FG-5750 StormMax by Oldcastle BuildingEnvelope
2) IP2551 by Arcadia
3) IR 501 by Kawneer

## 2.03 STOREFRONT SYSTEM PERFORMANCE REQUIREMENTS

A. Provide test reports from AAMA accredited laboratories certifying performances if requested:

1. Air Leakage: Meet requirements of ASTM E283.
2. Limit air leakage through assembly to 0.06 CFM/min/sq ft (.00003 m3/sm2) of wall area at 6.24 PSF (300 Pa) as measured in accordance with ASTM E283.
3. Water Resistance: No water leakage when measured in accordance with ASTM E331 with static test pressure of 8PSF (384 Pa) as defined by AAMA 501.
4. Dynamic Water Resistance: No water leakage, when measured in accordance with AAMA 501 with dynamic test pressure of 8 PSF (384 Pa).
5. Limit mullion wind load deflection of L/175 with full recovery of glazing materials, when measured in accordance with ASTM E330/E330M.
6. System shall not deflect more than 1/8 inch (3 mm) at center point, or 1/16 inch (1.58 mm) at enter point of horizontal member, once dead load points have been established.
7. System shall accommodate expansion and contraction movement due to surface temperature differential of 180 deg F (82 deg C).
8. Seismic testing shall conform to AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.

## 2.04 MANUALLY OPERATED DOORS

A. Aluminum:
   1. 6063-T6 aluminum alloy or meet requirements of ASTM B221, alloy GS 10a T6.

B. Stiles:
   1. 3-1/2 inches by 1-3/4 inches by 0.125 inches (89 mm by 45 mm by 3.175 mm) thick nominal.

C. Top Rails:
   1. 3-1/2 inches minimum by 1-3/4 inches by 0.125 inches (89 mm minimum by 45 mm by 3.175 mm) thick nominal.

D. Bottom Rails:
   1. 10 inches minimum by 1-3/4 inches by 0.125 inches (254 mm minimum by 45 mm by 3.175 mm) thick nominal.

E. Construction:
   1. Manufacturer's standard.

F. Glazing Stops:
   1. Snap-in type with neoprene bulb-type glazing. Units shall be glazed from exterior side.

G. Weatherstripping:
   1. Neoprene bulb-type.
   2. Approved Products. See Section 01 6000 :
      a. EPDM or Vinyl Blade gasket by Oldcastle BuildingEnvelope
      b. Peri-Plus Seal (PPS) by Arcadia
      c. Sealair by Kawneer

H. Framing System Gaskets and Sealants:
   1. Manufacturer's standard, recommended by manufacturer for joint type:
   2. Sealants: As specified in Framing Components and Accessories.

I. Factory Finishing:
   1. Fluorocarbon Carbon: Comply with AAMA 2605:

a. Polyvinylidene Fluoride (PVDF) Resin-base finish (Kynar 500 or Hylar 5000) containing seventy (70) percent minimum (PVDF) in resin portion of formula and providing pencil hardness of 3H. Thermo-cured two-coat system consisting of corrosion inhibiting epoxy primer and topcoat factory-applied over properly pretreated metal.

b. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish etched, medium matte; clear coating 0.40 mils (0.01016 mm) to 0.70 mils (0.01778 mm) thick) complying with AAMA 611.1.

c. Approved Colors:
   1) Bone White by Oldcastle BuildingEnvelope
   2) Classic Bone White by Arcadia.
   3) Bone White by Kawneer.

d. Approved Manufacturers. See Section 01 6000 :
   1) BASF.
   2) PPG Industries, Inc.
   3) Valspar Corporation.

e. Approved Products. See Section 01 6200 :
   1) Non-Thermal:
      (a) MS-375 by Oldcastle BuildingEnvelope
      (b) MS362 Medium Stile by Arcadia.
      (c) 350 Medium Stile by Kawneer.

f. Approved Products - HVHZ. See Section 01 6200:
   1) Single Glazed:
      (a) MS-375 StormMax by Oldcastle BuildingEnvelope
      (b) MS362IP Medium Stile by Arcadia.
      (c) 350 IR by Kawneer.

## 2.05 GLAZING

A. Glazing as specified in Section 08 8000: 'Glass Glazing'.

B. Glazing Gaskets:
   1. Compression-type design with replaceable extruded EPDM rubber.

C. Spacers and Setting Blocks: Elastomeric.

D. Bond-Breaker (Sealer) Tape: Standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealant:
   1. Structural Sealant meeting requirements of ASTM C1184:
      a. Permanently elastic, non-shrinking, and non-migrating type for joint size and movement.
      b. Single-component neutral-curing silicone formulation compatible with system components specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in aluminum-framed systems indicated.
      c. Color: Black.
   2. Weather Sealant:

a. ASTM C920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weather seal sealant, and aluminum-framed-system manufacturers for this use.
b. Color: Match structural sealant.

## 2.06 HARDWARE

A. Hinging:
1. Top and bottom offset, ball bearing pivots per door leaf.

B. Overhead Door Closers:
1. Provide parallel arms on closers unless door position requires otherwise.
2. Closers shall allow for 180 degree opening and not be used as stop. Provide Cush-N-Stop or equivalent arm where wall stop cannot be used.
3. Adjust closers to provide maximum opening force as required by governing code authority.
4. Closers shall have following features:
   a. Adjustable sweep speed.
   b. Adjustable backcheck.
   c. Non-handed, non-sized.
   d. Cush arm by LCN or equal by Norton.
5. Approved Products. See Section 01 6000 .
   a. Surface mounted:
   b. 4041 Series parallel arm by LCN.
   c. 7500 Series Parallel arm by Norton.

C. Exit Devices:
1. Entry Doors:
   a. Operation:
      1) Entry shall be by key. Device shall be locked by cylinder from outside. Key shall be removable when cylinder is in locked or unlocked position.
      2) Dogging operation shall be by manufacturer’s accessible thumbturn cylinder function.
      3) Exterior Trim: Lever Handle or Pull equal to Kawneer CO-9 or Arcadia OPR- 9.
      4) Types: Rim Type. Provide type of strike that will allow installation of specified panic devices on storefront system specified.
2. Access Doors:
   a. Operation:
      1) Access accomplished by dogging device. Dogging operation shall be by accessible, permanent knob, not by removable allen wrench devices.
      2) Exterior Trim: Match Entry Doors.
      3) Types: Rim Type. Provide type of strike that will allow installation of specified panic devices on storefront system specified.
3. Emergency Egress Exit Doors:
   a. Operation:
      1) Exit only with no dogging.
      2) Exterior Trim: None.

3) Type: Rim Type with type of strike that will allow installation of specified panic devices on storefront system specified.
4) Color:
   (a) Equivalent to clear anodized.
5) Approved Products. See Section 01 6200 :
   (a) Apex Series by Precision.
   (b) 80 Series by Sargent.
   (c) 98 or 99 Rim Series by Von Duprin.

D. Low-Energy Swing Door Operator:
1. Meet requirements of ICC/ANSI 117.1 and BHMA A156.19.
2. Wall-mounted push button operation.
3. Solid state electronic control.
4. Adjustable closing speed and hold-open range.
5. Automatic and manual operating modes.
6. Metal cover finished to match door.
7. Approved Products. See Section 01 6000 :
   a. Besam SW100 by Besam (subsidiary of ASSA ABLOY) US-Monroe, NC www.besam.us.
   b. Horton Series 7100 Low Energy by Horton Automatics (Division of Overhead Door Corp.), Corpus Christi, TX www.hortondoors.com.
   c. Record 6100 Series Low Energy Swing Door Operator by Record-USA, Monroe, NC www.record-usa.com.
   d. Stanley Magic-Force by Stanley Access Technologies, Farmington, CT www.stanleyaccesstechnologies.com.

E. Thresholds:
1. Exterior:
   a. Design Criteria: Meet handicap accessibility requirements.
   b. Exterior to Paver Tile on Setting Bed: Manufacturer’s standard.
   c. Exterior to Thin-Set Paver Tile: Similar to Pemko 253, 254, or 255 Profile.
   d. Exterior to Carpet Tile: Similar to Pemko 273 Profile.
   e. At Vestibule with Paver Tile on Setting Bed: Manufacturer's standard meeting.
   f. At Vestibule at Retail Area with Floor Mat: Acceptable Manufacturers:
      1) Half Saddle Model 254A by Pemko, Ventura, CA www.pemko.com.
      2) Equals approved by Architect before installation. See Section 01 6200.
   g. All Others: Manufacturer's standard.
2. Interior:
   a. Design Criteria: Meet handicap accessibility requirements.
   b. Carpet Tile / Carpet to Carpet: Similar to Pemko 236.

F. Sweep Strips:
1. Quality Standard:
   a. Entrance Manufacturer's standard (cover cap with no exposed fasteners).
   b. Pemko 293100 N8.

G. Push / Pulls:

1. Approved Products. See Section 01 6000:
    a. PBR and OPR-9 by Arcadia.
    b. Kawneer CP and CO-9, clear anodized

H. High Security Cylinders And Cores:
1. ASSA Instacores with ASSA Profile 62 key system:
    a. Church And Factory Authorized Distributor:
        1) Clark Security Products, 135 West 2950 South, Salt Lake City, UT.
            (a) Local: (801) 487-3227.
            (b) Other: (800) 453-6430.
            (c) FAX: (801) 487-3254.
2. Medeco cores with Level Six HUK-IC keying system with special Church keyway:
    a. Church And Factory Authorized Distributors:
        1) Intermountain Lock & Supply Co, 3106 South Main, Salt Lake City, UT:
            (a) Utah: (801) 486-0079.
            (b) Other: (800) 453-5386.
            (c) FAX: (801) 485-7205.
        2) Clark Security Products, 135 West 2950 South, Salt Lake City, UT.
            (a) Local: (801) 487-3227.
            (b) Other: (800) 453-6430.
            (c) FAX: (801) 487-3254.
3. Schlage cores with Primus Level 4+ keying system with special Church side bit milling:
    a. Church And Factory Authorized USA Distributors:
        1) Architectural Building Supply, P O Box 65678, Salt Lake City, UT 84165- 0678 or 2965 South Main St, Salt Lake City, UT 84115.
            (a) (801) 486-3481.
            (b) FAX: (801) 484-6817.

I. Removable Mullion:
1. Approved Products. See Section 01 6000 .
2. Von Duprin 4954 steel mullion with KR4954 lock assembly.

J. Kick Plates:
1. Push side of Door only.
2. 10 inches (254 mm) high by width of door less 3/4 inch (19 mm) on each side.
3. Material: 0.050 inch (1.27 mm) thick Stainless Steel.
4. Acceptable Manufacturers:
    a. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
    b. Hager, St Louis, MO (800) 255-3590 or (314) 772-4400 www.hagerhinge.com.
    c. Ives, Wallingford, CT www.iveshardware.com.
    d. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
    e. Equal as approved by Architect before bidding. See Section 01 6000.

**2.07 FABRICATION**

A. Construction shall meet Manufacturer’s recommendations.

B. Fabricate components that, when assembled, have following characteristics:

1. Profiles sharp, straight, and free of defects or deformations.
2. Accurately fit joints; make joints flush, hairline and weatherproof.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
8. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements and for hardware attachment.

C. Fabricate in factory to dimensions required to fit framed openings detailed on Contract Documents. Joints shall be tightly closed.

D. Mortise in manner to give maximum hardware-door connection strength and neatness of appearance. Adequately reinforce with back plates or rivets to hold pivots and closers.

E. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

F. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

G. Storefront Framing: Fabricate components for assembly using manufactures standard installation instructions.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

### 2.08 HARDWARE FINISHES

A. Finishes for steel, brass, or bronze hardware items shall be satin chromium plated.

B. Materials other than steel, brass, or bronze shall be finished to match the appearance of satin chromium plated.

## PART 3 EXECUTION

### 3.01 INSTALLERS

A. Performance Standard Installers: See Section 01 6200 for definitions of Categories. See Section 01 4301 and ‘Quality Assurance’ in Part 1 ‘General’ for Installer Qualifications of this specification:
   1. General Contractor responsible for Installer(s), verification of qualifications, and performance. Contact Approved Manufacturer’s Representative specified in Part 2 ‘Products’ of this specification for potential installers if desired.

### 3.02 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

C. Verify that framed openings comply with Contract Document requirements.

D. Verify floor is level across entire width of automatic door opening.

E. Verify sill conditions are level and/or sloped away from openings as specified.

F. Verify wall framing is dry, clean, sound, and free of voids and offsets, construction debris, sharp edges or anything that will prevent a successful installation of storefront system.

G. Notify Architect and Owner in writing if framed openings are not as agreed upon.
   1. Do not install storefront entry and window frames until deficiencies in framed openings have been corrected to allow installation of standard entries and windows.
   2. Commencement of Work by installer is considered acceptance of substrate.

**3.03 INSTALLATION**

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install doors without warp or rack. Adjust doors and hardware to provide ninety (90) degree operation, tight fit at contact points and smooth operation.

J. Install exterior window units with through wall sill flashing.

K. Thresholds:
   1. Accurately cut thresholds to fit profile of storefront frame. Bed exterior thresholds in specified sealant at contact points with floor and make watertight.

L. Sealants:
   1. Apply in accordance with Section 07 9213 ‘Elastomeric Joint Sealant’ requirements.
   2. Caulk joints between frames and walls, both interior and exterior to provide weather tight installation.

M. Glazing Characteristics:
   1. Interior Vestibule Glazing: Clear.
   2. Exterior Storefront Doors And Sidelights Opening Into Foyers And Corridors:
      a. Clear interior pane and Clear exterior pane with Low E treatment on surface 2.
   3. All Other Exterior Storefront Doors And Storefront:
      a. Obscure interior pane with pattern on surface 3 and Clear exterior pane with Low E treatment on surface 2.

N. Set thresholds in bed of sealant and secure.

O. Install hardware using templates provided.
   1. See Section 08 7100 for hardware installation requirements.

P. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

**3.04 TOLERANCES**

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Set plumb, square, level, and in correct alignment and securely anchor to following tolerances:
   1. Variation from plane: Limit to 1/8 inch (3 mm) in 12 feet (3.6 meters); 1/4 inch (6 mm) over total length.
   2. Offset from Alignment: For surfaces abutting in line, limit offset to 1/16 inch (1.6 mm).
   3. Offset at Corners: For surfaces meeting at corner, limit offset to 1/32 inch (0.8 mm).
   4. Diagonal measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).
   5. Sidelites: Line up horizontal rail in sidelight with door rail.

**3.05 FIELD QUALITY CONTROL**

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

B. Field Tests and Inspections:
   1. Pull test doors, especially pairs of single doors separated by permanent mullions, to ensure security of opening.
   2. Make all necessary final adjustments to attain normal operation of each door and its mechanical hardware.

C. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with contract document requirements including removal and replacement of glass that has been broken, chipped, cracked, abraded, or damaged during construction period at no additional cost to the Owner.

**3.06 ADJUSTING**

A. Adjust operating hardware and sash for smooth operation.

B. Adjust swing doors for proper operation after glazing entry. After repeated operation of completed installation, re-adjust door for optimum operating condition and safety if required.

**3.07 CLEANING**

A. Follow Manufacturer’s written recommendations for cleaning and maintenance or guidelines of AAMA 609 & 610 ‘Cleaning and Maintenance Guide for Architecturally Finished Aluminum’ (combined documents). Avoid damaging protective coatings and finishes.

B. Remove protective material from pre-finished aluminum surfaces.

C. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

D. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

E. Remove nonpermanent labels, protective films, and clean surfaces following recommended procedures.

1. Do NOT remove permanent AAMA/CSA or NFRC labels.

F. Waste Management:
   1. Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**3.08 PROTECTION**

A. During Installation:
   1. Installer's Responsibility:
      a. During installation, all adjacent work shall be protected from damage.

B. After Installation:
   1. General Contractor's Responsibility:
      a. Institute protective measures required throughout remainder of construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

**END OF SECTION 08 4313**

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**SECTION 08 5113**
**ALUMINUM WINDOWS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash, operating sash, and infill panels.

B. Factory glazing.

### 1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.

B. Section 07 9200 - Joint Sealants: Sealing joints between window frames and adjacent construction.

C. Section 08 8000 - Glazing.

### 1.03 REFERENCE STANDARDS

A. AAMA 711 - Voluntary Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products 2013.

B. AAMA 851 - Fenestration Sealants Guide for Windows, Window Walls and Curtain Walls 2009.

C. AAMA 902 - Voluntary Specification for Sash Balances 2016.

D. AAMA 910 - Life Cycle Specifications and Test Methods for AW Class Architectural Windows and Doors 2016.

E. AAMA 1302.5-76 - Voluntary Specifications for Forced-Entry Resistant Aluminum Prime Windows Current Edition.

F. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2017.

G. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.

H. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

I. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

J. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.

L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

M. 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).

N. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials 2019.

O. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes 2020.

P. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2019c.

Q. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact 2017.

R. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.

S. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.

T. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

B. Participate in pre-installation conference.

C. Schedule conference before scheduled installation of aluminum windows.

D. In addition to agenda items specified in Section 01 3000, review following:
   1. Review Installation scheduling, coordination, and placement of windows.
   2. Review Manufacturer’s installation requirements to assure issuance of Manufacturer’s warranty.
   3. Before installing windows, review Manufacturer's submitted installation requirements and install first window, including flashing and sealant, to demonstrate standard for installation of remaining windows.

## 1.05 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's literature or cut sheet.
      b. Literature on glazing.
      c. Color and finish selection.
      d. Window U and SHGC Factors, written certificate from window manufacture.
   2. Shop Drawings: Submit before beginning framing. Show rough opening requirements.

B. Informational Submittals:
   1. Manufacturer Instructions:
      a. Manufacturer's published installation instructions for windows, flashing, and sealants.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Include copy of final, executed warranty.

## 1.06 QUALITY ASSURANCE

A. Certifications:
   1. Confirmation of ICC report for flashing.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.
   2. Examine and report damaged materials to Architect and/or Owner immediately.

B. B. Storage And Handling Requirements:
   1. Provide secure location protected from the weather and other trades.
   2. Store window units in an upright position in clean and dry storage area above ground and protect from weather.

C. Comply with requirements of AAMA CW-10.

D. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

## 1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

## 1.09 WARRANTY

A. Special Warranty:
   1. Provide written non-prorated Manufacturer's warranty including:
      a. Ten (10) years for seal failure.
      b. Five (5) years for failure of operating hardware.
      c. Five (5) years on stress cracks related to fabrication or installation problems.

# PART 2 PRODUCTS

## 2.01 MANUFACTURERS. SEE SECTION 01 6000.

A. Thermal Windows, Inc., Tulsa, Oklahoma:
   1. Contact Information:
      a. General: Phone (918) 663-7580, www.thermalwindows.com.
      b. Primary Contact: Seth Patterson (800) 259-7580 extension 1232, spatterson@thermalwindows.com.

## 2.02 MANUFACTURED WINDOW UNITS

A. Fixed Window:
   1. Fixed: Series 550.
   2. Fixed impact: TW4150HD.

## 2.03 DESIGN CRITERIA (FIXED WINDOW)

A. Performance:
   1. Comply with minimum test requirements of AAMA/WDMA/CSA 101/I.S.2/A440 for classification of specified window in following:
      a. Meet classification Class CW-PG35-FW for AAMA/WDMA/CSA 101/I.S.2/A440:
         1) Minimum Test Size: 60 inches (1 500 mm).
         2) Minimum Design Pressure: 35 lbf/sq ft (0.156 kn/sq ft).
         3) Deflection at Design Pressure: L/175.
         4) Minimum Structural Pressure: 52 lbf/sq ft (0.231 kn/sq ft).
         5) Minimum Water Pressure: 5.3 lbf/sq ft (0.024 kn/sq ft).
         6) Air Leakage Resistance: 0.3 cfm/sq ft (1.524 L/s/sq m) at 1.6 lbf/sq ft (0.007kn/sq ft).
   2. Structural:
      a. Meet requirements of AAMA/WDMA/CSA 101/I.S.2/A440 H-C45 specification.
   3. NFRC: Meet requirements of ANSI/NFRC 100 and ANSI/NFRC 200.
   4. Sound Transmission Class:
      a. Meet requirements of ASTM E90.
   5. Forced Entry:
      a. Meet requirements for AAMA 1302.5 and ASTM F588 Load Identification Level 10.

B. Material:
   1. Aluminum to be of proper alloy for commercial window construction.
   2. Extruded sections to be 6063-T5 aluminum alloy.

C. Frame:
   1. Main frame members to be nominal thickness as required by AAMA/WDMA/CSA 101/I.S.2/A440.
      a. Main frame to be 2-5/8 inch (67 mm) in depth.
   2. Main frames members to be extruded aluminum with a structural thermal barrier of high density low thermal conductivity polyurethane, poured and de-bridged.

D. Assembly:
   1. Main frame to be a mechanically joined construction.

2. Corner joints to be "seam sealed" with quality grade of sealant meeting requirements of AAMA 851.
3. All screws at joints of sash and main frame shall be secured into integral screw ports.

E. Glazing:
1. Factory glazed with butyl glazing tape and snap in extruded aluminum glazing bead containing vinyl insert.
2. Insulated glass units to be 1 inch (25 mm) overall thickness with two panes of double strength glass, separated by 3/4 inch (19 mm) air space.
3. Insulated glass units shall meet requirements of ASTM E2190, Class "A".

F. Finish:
1. Meet requirements of AAMA 2605 for Organic Coating on Extruded Aluminum.

G. Approved Color:
1. White.

H. Muntin Pattern:
1. Determined by building style selection - See plans.

**2.04 COMPONENTS**

A. Glazing Requirements:
1. Glazing Characteristics:
a. Obscure interior pane with pattern on surface 3 and Clear exterior pane with Low E treatment on surface 2.
2. Glazing Beads: Manufacturer's standard.

B. Glazing Requirements:
1. Glazing Characteristics:
a. Clear exterior pane and Clear interior pane with Low E treatment on surface 2 or 3.
2. Glazing Beads: Manufacturer's standard.

C. Flashing:
1. Self-adhesive rubberized asphalt with protective sheet.
2. Acceptable Products:
a. Flexwrap by duPont Tyvek, Wilmington, DE www.tyvek.com.
b. Eternabond, Mundelein, IL www.eternabond.com.
c. FortiFlash 20 mil by Fortifiber, Reno, NV www.fortifiber.com.
d. Vycor Self-Adhered Flashing by Grace Construction Products, Cambridge, MA www.na.graceconstruction.com.
e. Optiflash B-20 by Covalence Coated Products, Homer, LA www.covalencecoatedproducts.com.
f. BR20XL or Ice & Water Guard Window Sealing Tapes by Protecto Wrap, Denver, CO www.protectowrap.com.
g. Rufco-Shield Window & Door Flashing by Raven Industries, Sioux Falls, SD www.ravenind.com.
h. Equal as approved by Architect before installation. See Section 01 6000.

D. Anchoring Devices:
1. Aluminum or stainless steel.
2. Other corrosion-resistant or insulated anchors as specifically approved by Architect in writing before use.

E. Fasteners: Stainless steel.

F. Glazing Materials: See Section 08 8000.

G. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.
1. See Section 07 9200 for additional requirements.

**2.05 SOURCE QUALITY CONTROL**

A. Identification:
   1. When delivered to Project site, windows shall bear permanent label stating model of window and Manufacturer's name, or AAMA label.

**2.06 FINISHES**

A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch. Providing pencil hardness of 3H. Thermo-cured two-coat system consisting of corrosion inhibiting epoxy primer and topcoat factory-applied over properly pre-treated metal.

B. Finish Color: White.

C. Approved Manufacturers. See Section 01 6200:
   1. BASF.
   2. PPG Industries, Inc.
   3. Valspar Corporation.

D. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

E. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Evaluation And Assessment:
   1. Openings:
      a. Examine openings for adequacy in allowing successful installation and operation.
      b. Verify openings are prepared to specified dimensions and are plumb and level.
   2. Notify Architect in writing of inadequate conditions.
      a. Do not install windows until conditions have been corrected.
      b. Commencement of Work by installer is considered acceptance of substrate.

B. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 07 2500.

**3.02 PRIME WINDOW INSTALLATION**

A. Install windows in accordance with manufacturer's instructions.

B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

C. Install windows in accordance with ASTM E2112.

D. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

E. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

F. Install sill and sill end angles.

G. Set sill members and sill flashing in continuous bead of sealant.

H. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install windows after installation of air infiltration barrier. Integrate air infiltration barrier, flashing, and sealants as required to provide weather tight installation and comply with Manufacturer's instructions.

J. Avoid direct contact between aluminum and adjacent steel work by insulating with materials equal to 3M's EC 1202 tape if materials are in pressure contact or with bituminous paint if pressure between surfaces cannot be maintained.

K. Install glass and infill panels in accordance with requirements; see Section 08 8000.

### 3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

### 3.04 FIELD QUALITY CONTROL

A. Provide services of aluminum window manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. Field Inspections:
   1. Notify Architect when windows are to be delivered to Project site to allow opportunity for Architect's inspection before installation.
   2. After installation of windows and before installation of exterior wall finish, inspect windows and compare to installation standard accepted at Pre-Installation Conference.

D. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

### 3.05 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

B. Remove protective material from factory finished aluminum surfaces.

C. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

D. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

E. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

**END OF SECTION**

**SECTION 08 7100**
**DOOR HARDWARE**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, hollow metal, and doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Lock cylinders for doors that hardware is specified in other sections.

E. Thresholds.

F. Weatherstripping and gasketing.

### 1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealants for setting exterior door thresholds.

B. Section 08 0671 - Door Hardware Schedule: Schedule of door hardware sets.

### 1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BHMA A156.2 - Bored and Preassembled Locks and Latches; 2017.

C. BHMA A156.16 - Auxiliary Hardware; 2018.

D. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2018.

E. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

G. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

D. Provide hardware templates to Sections 08 1213, 08 1313, and 08 1429 within fourteen (14) days after Architect approves hardware schedule.

E. Supply necessary hardware installation templates to Section 06 2024 before pre-installation conference.

F. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Architect will schedule meeting at project site prior to Contractor occupancy.
   3. Owner will schedule meeting at project site prior to Contractor occupancy.
   4. Attendance Required:
      a. Contractor.
      b. Owner.

c. Architect.
d. Installer's Architectural Hardware Consultant (AHC).
e. Hardware Installer.
f. Owner's Security Consultant.

5. Agenda:
   a. Establish keying requirements.
   b. Verify locksets and locking hardware are functionally correct for project requirements.
   c. Verify that keying and programming complies with project requirements.
   d. Establish keying submittal schedule and update requirements.
6. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   a. Access control requirements.
   b. Key control system requirements.
   c. Schematic diagram of preliminary key system.
   d. Flow of traffic and extent of security required.
7. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
8. Deliver established keying requirements to manufacturers.

**1.05 SUBMITTALS**

A. 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.
   1. Manufacturer's cut sheets.
   2. Two (2) copies of Manufacturer’s installation, adjustment, and maintenance instructions for each piece of hardware. Include one (1) set in ‘Operations And Maintenance Manual’ and send one (1) set with hardware when delivered.
   3. Copy of hardware schedule.
   4. Written copy of keying system explanation.

B. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Submit hardware schedule indicating hardware to be supplied.
   2. Schedule shall indicate details such as proper type of strikeplates, spindle lengths, hand, backset, and bevel of locks, hand and degree opening of closer, length of kickplates, length of rods and flushbolts, type of door stop, and other necessary information necessary to determine exact hardware requirements.
   3. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   4. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
      a. Submit in vertical format; see Section 08 0671.
   5. List groups and suffixes in proper sequence.
   6. Provide complete description for each door listed.
   7. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   8. Include account of abbreviations and symbols used in schedule.

C. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
   2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
   3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

D. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Manufacturer’s installation, adjustment, and maintenance instructions for each piece of hardware.
      b. Record Documentation:
         1) Manufacturers documentation:
            (a) Manufacturer's literature and/or cut sheets.
            (b) Include keying plan and bitting schedule.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Neatly and securely package hardware items by hardware group and identify for individual door with specified group number and set number used on Supplier's hardware schedule.

B. Include fasteners and accessories necessary for installation and operation of finish hardware in same package.

# PART 2 PRODUCTS

## 2.01 SUPPLIERS

A. Approved Suppliers.
   1. Architectural Building Supply, Salt Lake City, UT www.cookandboardman.com:
      a. Contact Information: Russ Farley, phone (800) 574-4369, fax 801-484-6817, or e-mail russf@absdoors.com.
   2. Beacon Metals Inc, Salt Lake City, UT www.beacon-metals.com:
      a. Contact Information: Jared Butler, phone (801) 486-4884, cell (435) 216-2297, or e-mail Jared@beaconcdl.com.
   3. Midwest D-Vision Solutions, Salt Lake City, UT www.mwdsutah.com.
      a. Contact Information: Dan Mercer, office (801) 377-4355, cell (801) 618-9456, e-mail danm@mwdsutah.com.

## 2.02 DESIGN AND PERFORMANCE CRITERIA

A. 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. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
   a. Self-drilling (Tek) type screws are not permitted.
3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
4. Provide wall grip inserts for hollow wall construction.
5. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
6. 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.
7. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

## 2.03 FINISHES

A. Hardware Finishes:
   1. Finishes for brass or bronze hardware items shall be:
      a. ANSI / BHMA Finish Code 626.
         1) Description: Satin Chromium Plated.
         2) Base Metal: Brass. Bronze.
   2. Finishes for flat goods items may be:
      a. ANSI / BHMA Finish Code 630.
         1) Description: Satin Stainless Steel.
         2) Base Metal: Stainless Steel (300 Series).
   3. Materials other than steel, brass, or bronze shall be finished to match appearance satin chromium plated, except flat goods which shall be satin stainless steel.

## 2.04 HINGES

A. Manufacturer Contact List:
   1. Hager Companies, St Louis, MO www.hagerhinge.com.
   2. Ives, New Haven, CT www.iveshardware.com.
   3. McKinney, Scranton, PA www.mckinneyhinge.com.
   4. PBB, Ontario, CA www.pbbinc.com.
   5. BEST (dormakaba Americas), Indianapolis IN www.BESTaccess.com.

B. Hinges:
   1. Doors:
      a. Sizes:
         1) Non-Fire-Rated Doors:
            (a) 1-3/4 inch 44.5 mm non-fire-rated wood doors in wood frames: 4 inches by 4 inches.
            (b) 1-3/8 inch 35 mm wood or metal doors: 3-1/2 inches by 3-1/2 inches.
         2) Fire-Rated Doors:
            (a) 1-3/4 inch fire-rated doors in metal frames:
            (b) Standard: 4-1/2 inches by 4-1/2 inches.

(c) Wide Throw: 4-1/2 inches by width required.

2. Use non-removable pins on exterior opening doors.
3. Hinges on exterior doors shall be solid brass, plated to achieve specified finish.
4. Approved Products.
   a. Interior:
      1) Hager: BB 1279.
      2) Ives: 5BBI.
      3) McKinney: TA 2714.
      4) MacPro / McKinney: MPB79.
      5) PBB: BB81.
      6) BEST: FBB 179.
   b. Exterior:
      1) Hager: BB 1191.
      2) Ives: 5BBI.
      3) McKinney: TA 2314.
      4) PBB: BB21.
      5) BEST: FBB 191.

**2.05 SECURING DEVICES**

A. Definitions:
   1. Grade 2 Standard Duty Key-In Lever Cylindrical Lockset:
      a. Performance Features:
         1) Exceeds 400,000 ANSI cycles.
         2) Single motion egress provides easy emergency exit.
         3) Full 1 inch (25 mm) throwbolt with saw resistant hardened steel roller pin.
         4) Anti-drill design deadbolt. Two (2) ball bearings inserted to prevent drill attacks.
         5) ADA-compliant thumbturn.

B. Manufacturers:
   1. Manufacturer List:
      a. Precision Hardware, Romulus, MI www.precisionhardware.com.
      b. Rockwood, Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
      c. Sargent, New Haven, CT www.sargentlock.com.
      d. Schlage, Colorado Springs, CO www.schlage.com.
      e. Von Duprin, Indianapolis, IN www.vonduprin.com.
      f. Yale Commercial Locks, Lenoir City, TN www.yalecommercial.com.

C. General:
   1. Backsets shall be 2-3/4 inches (70 mm).

D. Flush Bolts:
   1. Rod length: 12 inch minimum.
   2. Acceptable Products:
      a. Manual Flush Bolts (Wood Doors):
         1) Hager 283D.
         2) Ives FB458.
         3) Rockwood 555.

3. Dust Proof Strike:
    a. Floor and/or threshold.
    b. Acceptable Products:
        1) Hager: 280X.
        2) Ives: DP2.
        3) Rockwood 570.
        4) Equal as approved by Architect before installation. See Section 01 6200.

E. Locksets And Latchsets:
1. Design Criteria:
    a. Grade 1 Heavy Duty Key-In Lever Cylindrical Lockset:
        1) ANSI/BHMA A156.2 Series 4000 Grade 1.
        2) Meet UL 3 hour fire rating.
        3) Meet ADA Compliant ANSI A117.1 Accessibility Code.
        4) Door Lever:
            (a) Meet California code for 1/2 inch (12.7 mm) or less return to door.
            (b) Vandal-Resistant Lever with clutch.
        5) Deadlocking Latchbolt.
    b. Grade 2 Standard Duty Key-In Lever Cylindrical Lockset:
        1) ANSI/BHMA A156.2 Series 4000 Grade 2.
        2) Meet UL 3 hour fire rating.
        3) Meet ADA Compliant ANSI A117.1 Accessibility Code.
        4) Door Lever:
            (a) Meet California code for 1/2 inch (12.7 mm) or less return to door.
2. Lever Operated:
    a. Approved Products. See Section 01 6200:
        1) Grade 1 Heavy Duty Key-In Lever Cylindrical Locksets (Used only in Meetinghouse Module doors with CES Seminary and Institute additions:
            (a) 9K Series Best Lock with 15D Lever by BEST Access Solutions standard cylinders - (I/C cores may be used when authorized by AEC).
            (b) 195 Series with American Lever by Marks USA.
            (c) 10 Line Series with L Lever by Sargent.
            (d) ND Series with Rhodes (RHO) Lever by Schlage.
        2) Grade 2 Standard Duty Key-In Lever Cylindrical Locksets:
            (a) 7K Series Best Lock with 15D Lever by BEST Access Solutions standard cylinders - (I/C cores may be used when authorized by AEC).
            (b) 175 Series with American Lever by Marks USA.
            (c) 7 Line Series with L Lever by Sargent.
            (d) AL Series with Saturn (SAT) Lever by Schlage.

F. Deadbolts:
1. Approved Products. See Section 01 6000:
    a. Match manufacturer of locksets.

G. Standard Cylinders:
1. Provide cylinders for interior exit devices requiring cylinders.

H. Exit Devices:

1. Use operable lever trim.
2. Provide labeled hardware where required by local code authority.

I. Exit Devices:
1. Use operable lever trim.
2. Provide labeled hardware where required by local code authority.
3. Approved Products.
   a. 2000 Series by BEST Precision.
   b. 80 Series by Sargent.
   c. 99 or 98 Series by Von Duprin.
   d. 7100 Series by Yale.

J. Padlocks:
1. Quality Standard: Abus 83 / 45 Series with cylinder to match locksets.

K. Chains:
1. 3/16 inch (4.76 mm) diameter lightweight welded steel chain, case-hardened, zinc-plated, with flexible vinyl protective cover.
2. Quality Standard: Master Lock No. 73 bike locking chain.

**2.06 DOOR PULLS AND PUSH BARS**

A. Standard Door Push / Pulls:
1. Size: 15 inches (380 mm) by 3-1/2 inch (89 mm).
2. Acceptable Products:
   a. PS3515, PL3515 / 80301 by Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
   b. 39E, 30S by Hager, St Louis, MO www.hagerhinge.com.
   c. 8200, 8302 by Ives, Wallingford, CT www.iveshardware.com.
   d. 70B, 105x70B by Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
   e. Equal as approved by Architect before installation. See Section 01 6000.

**2.07 COORDINATORS**

A. Approved Products. See Section 01 6000:
1. CO2 x FB1 by Glynn Johnson.
2. 297D by Hager.
3. Series 900 by Ives.
4. 1600 Series by Rockwood.

B. Meeting Stiles:
1. Acceptable Products:
   a. [Insert Product] by Hager.
   b. 136N by NGP.
   c. 369AS by Pemko.

C. Astragals:
1. Acceptable Products:
   a. 835S by Hager.
   b. 139 DKB by NGP.
   c. 357D by Pemko.

## 2.08 CLOSERS

A. Approved Manufacturers.
   1. 8900 Series by Dorma Architectural Hardware, Reamstown, PA www.dorma.com/usa.
   2. 1461 Series by LCN Closers, Princeton, IL www.lcnclosers.com.
   3. 8501 Series by Norton Door Controls, Charlotte, NC www.nortondoorcontrols.com.
   4. 1431 Series by Sargent, New Haven, CT www.sargentlock.com.
   5. HD7000 Series by BEST (dormakaba Americas), Indianapolis IN www.BESTAccess.com.

B. Surface-Mounted Overhead Door Closers:
   1. Closers provided under this Section shall be from same Manufacturer.
   2. Provide parallel arms on closers unless door position in relation to adjacent wall requires otherwise. Provide covers.
   3. Door Closers on doors that swing 180 degree as shown on Contract Documents:
      a. Closers shall allow for 180 degree opening without engaging stop function. Wall stop or Floor stop is specified in Door Schedule and Section 08 7108, 'Stops And Holders'.
      b. Closers shall have following features:
         1) Adjustable sweep speed.
         2) Adjustable backcheck.
         3) Non-handed, non-sized.
         4) Hold open arm function (Friction Hold Open) (Non-Fire-Rated Corridors).
         5) Delayed action closing where noted on Door Schedule.
   4. Door Closers on doors that swing 90 degree as shown on Contract Documents:
      a. Closers shall allow for 100 degree opening with engaging stop function.
      b. Closers shall have following features:
         1) Adjustable sweep speed.
         2) Adjustable backcheck.
         3) Non-handed, non-sized.
         4) Hold open arm function with thumb turn or handle control (Cush And Hold) (Non-Fire- Rated Corridors).
         5) Delayed action closing where noted on Door Schedule.

## 2.09 KICK PLATES

A. Acceptable Manufacturers:
   1. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
   2. Hager, St Louis, MO (800) 255-3590 or (314) 772-4400 www.hagerhinge.com.
   3. Ives, Wallingford, CT www.iveshardware.com.
   4. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.

B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
   1. Material: 0.050 inch thick stainless steel.
   2. Size: 10 inch high by 2 inch less door width (LDW) on push side of door.

## 2.10 STOPS AND HOLDERS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.

b. Hager, St Louis, MO www.hagerhinge.com.
c. Ives, Wallingford, CT www.iveshardware.com.
d. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
e. Sargent, New Haven, CT (800) 906-6606 or (203) 562-2151 www.sargentlock.com.

B. Stops:
1. Use wall type stops unless indicated otherwise on Door Schedule.
2. Provide model appropriate for substrate. Wall stops may be either cast or wrought.
3. Acceptable Products:
a. Interior Wall Exterior Wall Floor Mount Overhead.
b. Hager 236W 255W 243F
c. Ives WS407CCV WS447 FS438
d. Rockwood 409 474 / 475 440 / 441
e. Glynn Johnson GJ 90S
f. Sargent 590S Series

## 2.11 ACCESSORIES

A. Manufacturers:
1. Manufacturer Contact List:
a. Hager, St Louis, MO www.hagerhinge.com.
b. Ives, Wallingford, CT www.iveshardware.com.
c. NGP - National Guard Products, Memphis, TN www.ngpinc.com.
d. Pemko Manufacturing, Ventura, CA www.pemko.com.

B. Acoustical Seals:
1. Color as selected by Architect.
2. Acceptable Products:
a. Door Bottom Shoe for Wood Door:
1) 13VDkB by NGP.
2) 211DV by Pemko.
b. Door Bottom Shoe for Metal Door:
1) 779S-A by Hager.
2) 35EV by NGP.
3) 217AV by Pemko.

C. Smoke Gaskets:
1. Color as selected by Architect.
2. Acceptable Products:
a. 726 by Hager.
b. 5050 by NGP.
c. PK 55 by Pemko.

D. Sweepstrip (metal door bottom):
1. Clear anodized aluminum with black neoprene insert.
2. Reduce infiltration of air, wind, dust, rain, and snow.
3. Meet UL requirements.
4. For use with saddle thresholds.
5. Acceptable Products:

a. 750S CLR by Hager.
b. 198N A by NGP.
c. 321 CN by Pemko.
d. Equal as approved by Architect before bidding. See Section 01 6000.

E. Thresholds:
1. Acceptable Products:
a. Design Criteria:
1) Meet handicap accessibility requirements (ADA):
b. Interior Doors at Acoustic Seals, Approved Products:
1) Carpet threshold (carpet to carpet):
(a) 505S DBA by Hager.
(b) 414 DKB by NGP.
(c) 236 D by Pemko.
2) Carpet threshold (carpet to concrete, wood, synthetic, or resilient flooring:
(a) 417 DKB by NGP.
(b) 174 D by Pemko.
3) Saddle threshold:
(a) 418S DBA by Hager.
(b) 411 DKB by NGP.
(c) 151 D by Pemko.
c. Out swinging metal exterior doors (from occupied rooms such as Serving Areas or Classrooms):
1) 8426 by NGP.
2) 253 x 3 FG by Pemko.
d. Out swinging metal exterior doors (exterior Utility Rooms only):
1) 891 V by NGP.
2) 185 V by Pemko.

F. Latch Guards
1. Acceptable products
a. LG12 by Ives
b. NLP-110 by Donjo

G. 154 Stablizers
1. Acceptable Products
a. Von Duprin Model MT54

## 2.12 WEATHERSTRIPPING AND GASKETING

A. Weatherstripping:
1. Acceptable Products:
a. Finish: clear anodized aluminum.
b. Perimeter:
1) 800S by Hager.
2) A625 A by NGP.
3) 35041 CP by Pemko.
c. Equal as approved by Architect before bidding. See Section 01 6000.

d. Bottom (see Sweepstrip).

### 2.13 KEY CABINET

A. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
   1. Mounting: Wall-mounted.
   2. Capacity: 60 hooks minimum.

## 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.

B. Verify that electric power is available to power operated devices and of correct characteristics.

### 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. Install hardware for smoke and draft control doors in accordance with NFPA 105.

D. Use templates provided by hardware item manufacturer.

E. Do not install surface mounted items until application of finishes to substrate are fully completed.

F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. Mounting heights in compliance with ADA Standards:
      a. Locksets: 40-5/16 inch.
      b. Push Plates/Pull Bars: 42 inch.
      c. Deadlocks (Deadbolts): 48 inch.
      d. Exit Devices: 40-5/16 inch.
      e. Door Viewer: 43 inch; standard height 60 inch.

G. Install smoke gaskets and acoustical seals in manner to give continuous air-tight fit.
   1. Install smoke gaskets as per Manufacturer’s installation requirements:
      a. Hinge Jamb: Install smoke gaskets on jamb face of door frame so door will compress smoke gasket.
      b. Header and Strike Jamb: Install smoke gaskets on face of stop of door frame so door will compress smoke gasket.
   2. Install acoustical seal with seal under door.

H. 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.
   1. See Section 07 9200 for additional requirements.

I. Turn key cabinet over to Owner's designated representative at Substantial Completion with all keys required for every locking device on Project identified by tags and on hooks. Owner will be responsible for installation.

### 3.03 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

B. Owner’s Instructions:

1. Before Final Acceptance Meeting, send master keys to [Insert Person to Receive Keys].

### 3.04 ADJUSTING

A. Adjust hardware for smooth operation.

B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

C. Adjust closers to provide maximum opening force as required by governing code authority and proper backcheck and sweep speed.

### 3.05 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.

### 3.06 PROTECTION

A. Do not permit adjacent work to damage hardware or finish.

**END OF SECTION 08 7100**

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**SECTION 08 8000**
**GLAZING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Plastic films.

D. Glazing compounds.

### 1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework: Cabinets with requirements for glass shelves.

### 1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).

C. ASTM C1036 - Standard Specification for Flat Glass 2021.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

G. ASTM C1281 - Standard Specification for Preformed Tape Sealants for Glazing Applications 2016.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.

I. GANA (GM) - GANA Glazing Manual 2008.

J. GANA (SM) - GANA Sealant Manual 2008.

K. GANA (LGRM) - Laminated Glazing Reference Manual 2019.

L. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

### 1.04 SUBMITTALS

A. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, Plastic Film, and Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

C. Samples: Submit two samples 12 by 12 inch in size of glass units.

D. Installer's qualification statement.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

## 1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), IGMA TM-3000, for glazing installation methods. Maintain one copy on site.

B. Installer Qualifications:
   1. Installer: Requirements of Section 01 4301 applies, but not limited to following:
      a. Satisfactorily completed at least three (3) installations of similar size, scope, and complexity in each of past two (2) years and be approved by glass product Manufacturer before bidding.
      b. Upon request, submit documentation.

C. Certifications:
   1. Labels showing strength, grade, thickness, type, and quality are required on each piece of glass.
   2. Manufacturers/Fabricators certifying products furnished comply with project requirements.
   3. Insulating-Glass Certification Program: Indicate compliance with requirements of Insulating Glass Certification Council on applicable glazing products.

## 1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Follow Manufacturer’s instruction for receiving, handling, and protecting glass & glazing materials to prevent breakage scratching, damage to seals, or other visible damage.
   2. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Storage And Handling Requirements:
   1. Follow Manufacturer’s instruction for storing and protecting glass & glazing materials.
   2. Store materials protected from exposure to harmful environmental conditions and at temperatures and humidity conditions recommended by Manufacturer.
   3. Protect edge damage to glass, and damage/deterioration to coating on glass.

## 1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.

## 1.08 WARRANTY

A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty, signed by insulating-glass Manufacturer/Fabricator, agreeing to replace insulating-glass units to include coverage for seal failure, moisture, interpane dusting or misting, including providing products to replace failed units from date of installation.

B. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units from date of installation.

C. Installer’s Warranty:

1. Form acceptable to Owner, signed by glass product Installer, agreeing to replace glass products that deteriorate, or that exhibit damage or deterioration of glass or glazing products due to faulty installation, for two (2) years from date of installation.

D. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Manufacturer Contact List for Low E Glazing:
   1. AGC Flat glass North America, Kingsport, TN www.us.agc.com.
   2. Carlex (subsidiary of Central Glass Co., Ltd., Nashville, TN www.carlex.com.
   3. Guardian Industries Corp., Auburn Hills, MI www.guardian.com.
   4. Oldcastle Building Envelope, Santa Monica, CA www.oldcastlebe.com
   5. Pilkington North America Inc., Toledo, OH www.pilkington.com.
   6. Vitro Architectural Glass (formerly PPG glass), Cheswick, PA www.ppgglass.com or PPG Canada Ltd, Glass Division, Toronto, ON (416) 789-3331.

### 2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Glass units for exterior fixed windows, monumental and vent sash window units shall have U Factor of 0.34 and SHGC of 0.33. Provide written Manufacturer's confirmation with glazing submittal.

B. Exterior Window Glazing:
   1. Thickness: 1/8 inch (3 mm) minimum, Double Strength (Insulated Glass).
   2. Glazing shall have following characteristics:
      a. Low-Emissivity (or Low E):
         1) Design Criteria:
            (a) Clear:
            (b) Meet requirements of ASTM C1036, Type I, Class I, Quality Q3.
            (c) Location: Surface 2.
         2) Low-Emissivity (or Low E) Acceptable Product:
            (a) Performance Standard:
            (b) 70 percent Visible Light Transmission (VLT).
            (c) 0.29 U-value winter.
            (d) 0.27 U-value summer.
            (e) 0.38 Solar Heat Gain Coefficient (SHGC).
            (f) 0.44 Shading Coefficient.
            (g) 11 percent Visible Light Reflectance.
            (h) Quality Standard:
            (i) Cardinal LoE³-366.
            (j) Solarban 70 XL.
            (k) Other low E glazing system standard with window manufacturer that meets or exceeds performance characteristics of specified glazing is acceptable as approved by Architect before bidding. See Section 01 6000.
         3) Acceptable Manufacturers:

(a) AGC.
(b) Guardian.
(c) Vitro Architectural Glass.
(d) Equal as approved by Architect before bidding. See Section 01 6000.

b. Obscure:
1) Design Criteria:
(a) Meet requirements of ASTM C1036, Type II, Class I, Form 3, Quality Q8, Pattern - #62.

c. Glazing in Windows within 24 inches (600 mm) of Exterior Doors:
1) Design Criteria:
(a) Tempered.
(b) Meet requirements of ASTM C1048, Kind FT, Condition A, Type I, Class I, Quality Q3.

C. Storefront Glazing:
1. Thickness: 1/4 inch (6 mm).
2. Glazing shall have following characteristics:
a. Low-Emissivity (or Low E):
1) Design Criteria:
(a) Clear.
(b) Insulated Glass: 1 inch (25 mm) units with 1/2 inch (13 mm) airspace and two (2) 1/4 inch (6 mm) lites.
(c) Meet requirements of ASTM C1036, Type I, Class I, Quality Q3.
(d) Location: Surface 2.
2) Low-Emissivity (or Low E) Acceptable Product:
(a) Performance Standard:
(b) 64 percent Visible Light Transmission (VLT).
(c) 0.28 U-value winter.
(d) 0.26 U-value summer.
(e) 0.27 Solar Heat Gain Coefficient (SHGC).
(f) 0.32 Shading Coefficient.
(g) 12 percent Visible Light Reflectance.
(h) Quality Standard:
(i) Cardinal LoE³-366.
(j) Solarban 70 XL.
(k) Equal product by Acceptable Manufacturer as approved by Architect before bidding. See Section 01 6000.
3) Acceptable Manufacturers:
(a) AGC.
(b) Guardian.
(c) Vitro Architectural Glass.
(d) Equal as approved by Architect before bidding. See Section 01 6000.
b. Obscure:
1) Design Criteria:

(a) Meet requirements of ASTM C1036, Type II, Class I, Form 3, Quality Q8, Pattern - #62.

c. Glazing Below Door Height:

1) Design Criteria:

(a) Tempered.

(b) Meet requirements of ASTM C1048, Kind FT, Condition A, Type I, Class I, Quality Q3.

D. Fabrication:

1. Except where glass exceeds 66 inches (1 675 mm) in width, cut clear glass so any wave will run horizontally when glazed.
2. Install muntins for exterior aluminum entries and aluminum windows between panes of insulating glazing units. No muntins on interior Vestibule storefront entries.
3. Sealed, Insulating Glazing Units:
   a. Double pane, sealed insulating glass units. Install at exterior windows and exterior aluminum-framed storefront.
   b. Unit Thickness: 5/8 inch (16 mm) minimum, one inch (25 mm) maximum.
   c. Insulated obscure units shall consist of one pane of specified obscure glass and one pane of standard glass.
   d. Type Seal:
      1) Metal-to-glass bond and separated by 1/2 inch (12.7 mm) dehydrated air space.
      2) Use non-hardening sealants.
   e. Approved Fabricators. See Section 01 6000
      1) Members of the Insulating Glass Manufacturers Alliance (IGMA).

## 2.03 ACCESSORIES

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Glazing Tape: Butyl-based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for specified installation, complying with ASTM C1281 and AAMA 800 for application

C. 3M Sun Control Window Fillm Night Vision NV-25: -DI retail windows and vestibule windows only by Owner approval.

# PART 3 EXECUTION

## 3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

**3.03 INSTALLATION, GENERAL**

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

**3.04 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

**3.05 CLEANING**

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

**3.06 PROTECTION**

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

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**SECTION 09 2116**
**GYPSUM BOARD ASSEMBLIES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal channel ceiling framing.

C. Resilient sound isolation clips.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Cementitious backing board.

G. Gypsum wallboard.

H. Joint treatment and accessories.

I. Textured finish system.

### 1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Building framing and sheathing.

B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

### 1.03 REFERENCE STANDARDS

A. ASTM C11 - Standard Terminology Relating to Gypsum and Related Building Materials and Systems 2018b.

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

F. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2022.

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 2022.

I. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.

J. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

N. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.

O. ASTM E413 - Classification for Rating Sound Insulation 2022.

P. GA-214 - Levels of Finish for Gypsum Panel Products 2021.

Q. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

R. GA-600 - Fire Resistance and Sound Control Design Manual 2021.

S. GA-801 - Handling and Storage of Gypsum Panel Products: A Guide for Distributors, Retailers, and Contractors 2017.

T. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

U. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.
   1. Schedule MANDATORY pre-installation conference immediately before installation of gypsum wallboard.
   2. In addition to agenda items specified in Section 01 3000, review following:
      a. Finish requirements necessary for installation of finish materials over gypsum wallboard, and location and installation of ceramic tile backerboard.

## 1.05 SUBMITTALS

A. Product Data:

B. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections. Also provide fire test results or assembly diagrams and numbers confirming products used will provide required fire ratings with installation configurations used.

C. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches in size, illustrating finish color and texture.
   1. Hawk and Trowel, Multi-Directional (lightly sanded) Texture:
      a. Provide minimum of three (3) 24 inch (600 mm) square control samples on primed gypsum wallboard of ‘multi-directional’ texture (70/30, 80/20, and 90/10) to show possible variations.

D. Field Samples:
   1. Before performing work of this Section, prepare control samples.
   2. Architect will inspect control sample at pre-installation conference following preparation of control sample. When sample is approved, work of this Section may proceed. Approved samples will be kept at site at all times work of this section is being performed.

## 1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Follow recommendations of GA-801 Guide for Handling and Storage of Gypsum Panel Products unless local, state or federal laws or agency rules differing from the recommendations shall take precedence.

C. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

D. Store material under roof and keep dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack gypsum board flat to prevent sagging.

### 1.07 FIELD CONDITIONS

A. Ambient Conditions:
   1. Comply with ASTM C840 or GA-216 requirements, whichever are more stringent:
      a. Do not install interior products until installation areas are enclosed and conditioned.
         1) Temperature shall be 50 deg F (10 deg C) and 95 deg F (35 deg C) maximum day and night during entire joint operation and until execution of Certificate of Substantial Completion.
         2) Provide ventilation to eliminate excessive moisture.
         3) Avoid hot air drafts that will cause too rapid drying.
      b. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

## 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.

### 2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   4. National Gypsum Company: www.nationalgypsum.com/#sle.
   5. PABCO Gypsum: www.pabcogypsum.com/#sle.
   6. USG Corporation: www.usg.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut, long edges tapered.
   1. General:
      a. Size:
         1) Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
      b. Quality Standard:
         1) Core: Fire-resistant rated gypsum core.
         2) Complies with Type X requirements of ASTM C1396/C1396M (Section 5).
         3) Surface paper: Face paper suitable for painting.
         4) Long edges: Tapered edge.
   2. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
   5. Paper-Faced Products:
      a. American Gypsum Company; LightRoc Gypsum Wallboard: www.americangypsum.com/#sle.

b. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
c. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
d. Georgia-Pacific Gypsum; ToughRock: www.gpgypsum.com/#sle.
e. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
f. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.

C. Impact Resistant Wallboard:
1. Type: Fire-resistance-rated Type X, UL or WH listed.
2. Thickness: 5/8 inch.
3. Edges: Tapered.
4. Paper-Faced Products:
a. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Hi-Impact Gypsum Board: www.goldbondbuilding.com/#sle.
b. USG; Fiberrock VHI (Very High Impact) Abuse-Resistant Board.

D. Backing Board For Wet Areas:
1. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel.
a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
b. Square edges.
c. Products:
1) DensShield Fireguard Type X by Georgia Pacific.
2) GlasRoc Tilebacker Type X by CertainTeed.

## 2.03 GYPSUM BOARD ACCESSORIES

A. Manufacturers:
1. Manufacturer Contact List:
a. Kinetics Noise Control, Dublin, OH www.kineticsnoise.com.
b. Magnum Products, Lenaxa, KS www.levelcoat.com.
c. National Gypsum, Charlotte, NC www.nationalgypsum.com.
d. Soundproofing Co, San Marcos, CA www.soundproofing.org.
e. United States Gypsum Co, Chicago, IL www.usg.com.
f. Westpac Materials Inc, Orange, CA www.westpacmaterials.com.
g. Wm. Zinsser & Co, Somerset, NJ www.zinsser.com.

B. Corner And Edge Trim:
1. Metal, paper-faced metal, paper-faced plastic, or solid vinyl meeting requirements of ASTM C1047. Surfaces to receive bedding cement treated for maximum bonding.

C. Control Joint:
1. Bent zinc sheet with V-shaped slot, perforated flanges, covered with plastic tape meeting requirements of ASTM C1047.

D. Furring Channels:
1. Quality Standards:
a. Walls: Galvanized DWFC-25.
b. Ceilings: Galvanized DWFC-20.
2. Accessories as required by Manufacturer's fire tests to provide necessary fire ratings.

E. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 2 inch.

F. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant. Supplied and installed in accordance with ASTM Standards. Including but not limited to ASTM C919-19; do not use solvent-based non-curing butyl sealant.

G. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, 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.

H. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
   1. Expansion Joints:
      a. Type: V-shaped metal with factory-installed protective tape.

I. Joint Materials: Best grade or 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 Reinforcing:
      a. Paper reinforcing tape acceptable to Gypsum Board Manufacturer.
   3. Joint Compound: Drying type, vinyl-based, ready-mixed. Best grade or type recommended by Board Manufacturer and meeting requirements of ASTM C475/C475M.
      a. Use Taping Compound for first coat to embed tape and accessories.
      b. Use Taping Compound or All-Purpose Compound for subsequent coats except final coat.
      c. Use Finishing Compound for final coat and for skim coat.

J. Finishing Compound: Surface coat and primer, takes the place of skim coating.

K. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
   1. Products:
      a. Sheetrock First Coat by USG.
      b. Prep Coat by Westpac Materials.
      c. Level Coat by Magnum Products.
      d. Equal as approved by Architect before bidding. See Section 01 6200.

L. Primer On Surfaces To Receive Wallcovering:
   1. White, self-sizing, water based, all purpose wallcovering primer.
   2. Acceptable Products:
      a. Shieldz Universal Pre-Wallcovering Primer by Wm. Zinsser and Company.

M. Primer / Surfacer On Surfaces To Receive Texturing:
   1. Acceptable Products:
      a. Sheetrock First Coat by USG.
      b. Prep Coat by Westpac Materials.
      c. Level Coat by Magnum Products.
      d. Equal as approved by Architect before bidding. See Section 01 6200.

N. Textured Finish Materials: Latex-based compound; plain.
   1. Products:
      a. ProForm Perfect Spray EM/HF by National Gypsum.
      b. Sheetrock Wall & Ceiling Texture by US Gypsum.

O. Fasteners:
   1. Bugle head screws meeting requirements of ASTM C1002:
      a. Gypsum Board:
         1) Type W: For fastening gypsum board to wood members, of length to penetrate wood framing 5/8 inch (15.9 mm) minimum.
         2) Type S: For fastening gypsum board to steel framing and ceiling suspension members, of length to penetrate steel framing 3/8 inch (9.5 mm) minimum.
      b. Glass Mat Gypsum Tile Backer:
         1) Wood Framing: 11 ga (0.1233 in) (3.1318 mm), galvanized with 7/16 inch (11 mm) head, hot dipped. Screws: Type W or Type S Hi-Lo, bugle head, rust resistant.
         2) Light-gauge metal framing: Type S Hi-Lo, bugle or wafer head, self-tapping, rust resistant. Hi-Lo screws.
         3) Heavy-gauge metal framing: Type S-12 Hi-Lo, bugle or wafer head, rust resistant.

P. 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.

Q. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

R. Screws for Fastening Gypsum Sheathing: Bugle head screws as recommended by Sheathing Manufacturer and meeting requirements of ASTM C1002, corrosion resistant treated.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

B. Examine gypsum board before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Notify Architect of unsuitable conditions in writing.
   1. Do not install board over unsuitable conditions.

D. Commencement of Work by installer is considered acceptance of substrate.

### 3.02 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

D. Acoustical Shielding: Install in accordance with manufacturer's instructions for application between studs and gypsum board.

E. Installation shall comply with ASTM C919-19

### 3.03 BOARD INSTALLATION

A. Interface With Other Work:
   1. Coordinate with Division 06 for location of backblocking for edges and ends of gypsum board and for blocking required for installation of equipment and building specialties.
   2. Do not install gypsum board until required blocking is in place.

B. General: Install and finish as recommended in ASTM C840 or GA-216 unless specified otherwise in this Section.

C. Mounting Accessories:
   1. Furring Channels: Apply with screws through flanges into each framing member.

D. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

E. 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.

F. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

G. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

H. Interior Gypsum Board:
   1. General:
      a. Install so trim and reinforcing tape are fully backed by gypsum board. No hollow spaces between pieces of gypsum board over 1/8 inch (3 mm) wide before taping are acceptable.
      b. Rout out backside of gypsum board to accommodate items that extend beyond face of framing, but do not penetrate face of gypsum board, such as metal door frame mounting brackets, etc.
      c. On walls over 108 inches (2 700 mm) high, apply board perpendicular to support.
      d. Butt edges in moderate contact. Do not force in place. Shim to level.
      e. Leave facings true with joint, finishing flush. Vertical work shall be plumb and ceiling surfaces level.
      f. Scribe work closely:
         1) Keep joints as far from openings as possible.
         2) If joints occur near an opening, apply board so vertical joints are centered over openings.
         3) No vertical joints shall occur within 8 inches (200 mm) of external corners or openings.
      g. Install board tight against support with joints even and true. Tighten loose screws.
      h. Caulk perimeter joints in sound insulated rooms with specified acoustical sealant.
   2. Ceilings:
      a. Apply ceilings first using minimum of two (2) men.
      b. Use board of length to give minimum number of joints.
      c. Apply board perpendicular to support.
      d. Chapel and Cultural Hall:
         1) Single Layer Application:
            (a) Stagger end joints:
               (1) End and edge joints of board applied on ceilings shall occur over framing members or be back blocked with 2x4 (38 mm by 89 mm) blocking.

(2) Edge joints of board vertically applied on walls shall occur over framing members.
(3) 2x4 (38 mm by 89 mm) blocking is required at wall to ceiling transitions and at top of ceiling vault transitions.

3. Fastening:
   a. Apply from center of board towards ends and edges.
   b. Apply screws 3/8 inch (9.5 mm) minimum from ends and edges, one inch (25 mm) maximum from edges, and 1/2 inch (13 mm) maximum from ends.
   c. Spacing:
      1) Ends: Screws not over 7 inches (175 mm) on center at edges where blocking or framing occurs.
      2) Wood Framed Walls And Ceilings: Screws 7 inches (175 mm) on center in panel field.
      3) Metal Framed Walls: Screws 12 inches (300 mm) on center in panel field.
   d. Set screw heads 1/32 inch (0.8 mm) below plane of board, but do not break face paper. If face is accidentally broken, apply additional screw 2 inches (50 mm) away.
   e. Screws on adjacent ends or edges shall be opposite each other.
   f. Drive screws with shank perpendicular to face of board.
4. Trim:
   a. Corner Beads:
      1) Attach corner beads to outside corners.
         (a) Attach metal corner bead with staples spaced 4 inches (100 mm) on center maximum and flat taped over edges of corner bead. Also, apply screw through edge of corner bead where wood trim will overlay corner bead.
         (b) Set paper-faced trim in solid bed of taping compound.
   b. Edge Trim: Apply where gypsum board abuts dissimilar material. Hold channel and 'L' trim back from exterior window and door frames 1/8 inch (3 mm) to allow for caulking.

I. Glass Mat Gypsum Tile Backer:
1. Apply glass mat gypsum tile backer to framing. Attach using specified fasteners spaced 6 inches (150 mm) on center on edges and into all framing members. Drive screws flush with surface of board.
2. Shim board to be plumb and flat or level and flat, depending on location.
3. Apply reinforcing only at joints where abutting different materials.

J. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

K. 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.

**3.04 INSTALLATION OF TRIM AND ACCESSORIES**

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

E. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

## 3.05 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Gypsum Board Surfaces not painted or finished:
      a. GA-214 Level 1: 'All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable'.
   2. Gypsum Board Surfaces Under Acoustical Tile:
      a. GA-214 Level 2: 'All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
      b. Note: It is critical that gypsum board ceiling be smooth before installing ceiling tile.
   3. Gypsum Board Surfaces to Receive: Wall Covering Type A - Section 09 7226: 'Sisal Wall Covering':
      a. GA-214 Level 3: 'All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Coat prepared surface with specified wall covering primer'.
   4. Gypsum Board Surfaces to Receive: Painted Texturing - Section 09 9413: 'Interior Textured Finishing':
      a. GA-214 Level 4: 'All and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Coat prepared surface with specified primer'.
   5. Gypsum Board Surfaces to Receive: Holy Smooth Gypsum Board Surfaces:
      a. GA-214 Level 4: 'All and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be Holy smooth and free of tool marks and ridges. Coat prepared surface with specified primer'.

D. Finishing:
   1. General:
      a. Tape and finish joints and corners throughout building as specified below to correspond with final finish material to be applied to gypsum board. When sanding, do not raise nap of gypsum board face paper or paper-faced trim.
      b. First Coat:

1) Apply tape over center of joint in complete, uniform bed of specified taping compound and wipe with a joint knife leaving a thin coating of joint compound. If metal corner bead is used, apply reinforcing tape over flange of metal corner bead and trim so half of tape width is on flange and half is on gypsum board.
2) Completely fill gouges, dents, and fastener dimples.
3) Allow to dry and sand lightly if necessary to eliminate high spots or excessive compound.

c. Second Coat:
1) Apply coat of specified joint compound over embedded tape extending 3-1/2 inches (88 mm) on both sides of joint center. Use finishing compound only if applied coat is intended as final coat.
2) Re-coat gouges, dents, and fastener dimples.
3) Allow to dry and sand lightly to eliminate high spots or excessive compound.

d. Third Coat: Apply same as second coat except extend application 6 inches (150 mm) on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.

e. Fourth Coat: Apply same as second coat except extend application 9 inches (425 mm) on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.

**3.06 TEXTURE FINISH**

A. Apply finish texture coating in accordance with manufacturer's instructions and to match approved sample.

B. Location:
1. Walls:
a. Holy Smooth:
1) All areas except those listed in following paragraph.
b. Hawk and Trowel:
1) Chapel.
2. Ceilings:
a. Hawk and Trowel, (or as approved by architect):
1) Bishop's Waiting Areas and corridor transition into Foyers (sides and bottoms of headers).
2) Chapel (Includes soffit and fascia of light cove).
3) High Council Rooms Areas where there is exposed gypsum board (includes soffit and fascia of coffered area at perimeter).
4) Relief Society and Primary Rooms Areas where there is exposed gypsum board (includes soffit and fascia of coffered area at perimeter).
b. Holy Smooth Finish (no applied texture) to be applied to the following ceilings:
1) Font.
2) Mechanical Rooms, Storage Rooms, and other Utility Areas.
3) Restrooms.
4) Serving Area.

C. Finishing:
1. Texture:
a. After gypsum board is taped, sanded, and primed, apply texture. Closely match samples accepted by Architect.
1) 1) After wall has been textured, apply priming and paint as specified in Section 09 9123.
2. Smooth:

a. a. No applied texture is required. Apply priming and paint as specified in Section 09 9123.

## 3.07 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Remove and replace panels that are wet, moisture damaged, and mold damaged.
      a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
      b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## 3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

## 3.09 CLEANING

A. Remove from site debris resulting from work of this Section including taping compound spills.

**END OF SECTION 09 2116**

**SECTION 09 2216**
**NON-STRUCTURAL METAL FRAMING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

### 1.02 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing 2020.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 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, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

G. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.

H. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.

I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

J. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring 2003 (Reapproved 2018).

K. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections 2018.

L. 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 2022.

M. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.

N. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Schedule pre-installation conference to be held after submittals have been reviewed and returned by Architect, but before beginning metal framing work.
   2. In addition to agenda items specified in Section 01 3000, review following:
      a. Identify location of required blocking.

B. Coordination:
   1. Coordinate layout of suspension system with other construction that penetrates ceilings or is supported by them, including drywall furring, light fixtures, HVAC equipment, and fire-suppression systems.

2. All work above ceiling should be completed prior to installing suspended system. There should be no materials resting against or wrapped around suspension system, hanger wires or ties.

## 1.04 SUBMITTALS

A. Shop Drawings:
   1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
   3. Seismic Design Categories D, E and F:
      a. Manufacturer’s details and installation instructions for seismic bracing. If requested, provide copy of code requirements applicable to Project.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Product Data: Provide Manufacturer's technical literature on suspension system including listing dimensions, load carrying capacity and standard compliance.

E. Samples:
   1. Minimum 8 inch long samples of suspension system components, including main runner/tee and cross runner/tee with couplings.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Certificates:
   1. Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
   2. Installer’s certificates of training.

## 1.05 QUALITY ASSURANCE

A. Qualifications. Requirements of Section 01 4301 applies, but not limited to following:
   1. Installer:
      a. Installer training (‘Ceiling Masters’ training course or equivalent).
   2. Manufacturer:
      a. Manufacturer in good standing of CISCA (Ceiling and Interior Systems Construction Association).

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

## 1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

C. Store material in fully enclosed space protected against damage from moisture, direct sunlight, surface contamination, and general damage.

## 1.07 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer standard ten (10) years warranty on suspension system including repair or replacement of rusting as defined by ASTM D610.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. CEMCO: www.cemcosteel.com/#sle.
   2. ClarkDietrich: www.clarkdietrich.com/#sle.
   3. Any member of Steel Framing Industry Association (SFIA).
   4. Any member of Steel Stud Manufacturer's Association (SSMA).
   5. Substitutions: See Section 01 6000 - Product Requirements.

### 2.02 FRAMING MATERIALS

A. Framing:
   1. General:
      a. 20 gauge minimum, unless noted greater on Drawings, meeting requirements of ASTM C645.
      b. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
      c. Steel Coating Requirement: Comply with ASTM C645 roll-formed from hot dipped galvanized steel complying with ASTM A1003/A1003M and/or ASTM A653/A653M G40 (Z120) or equivalent corrosion resistant coating. A40 galvannealed products are not acceptable.
         1) Coatings shall demonstrate equivalent corrosion resistance with evaluation report from approved testing agency.
   2. Steel Studs and Runners: Cold-formed galvanized steel C-studs, as per ASTM C645 for conditions indicated.
   3. Bridging, blocking, strapping, and other accessories shall be as described in Contract Documents or as required by Manufacturer's system.
   4. Acceptable Products:
      a. 362DS20P by CEMCO.
      b. ProSTUD 20 by ClarkDietrich Building Systems.
      c. 20 Ga 3-5/8 SS Series by Steeler Inc.
      d. Any member of Steel Framing Industry Association (SFIA).
      e. Any member of Steel Stud Manufacturer's Association (SSMA).
      f. Equal as approved by Architect before bidding. See Section 01 6200.

B. Furring Channels:
   1. Hat Shaped Channels: ASTM C645; 25 gauge corrosion resistant steel in sizes shown on Drawings.
   2. 'Z' Shaped Channels: 20 gauge minimum corrosion resistant steel in sizes shown on Drawings.

C. Firestop Tracks:
   1. Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Headers and Jambs - Heavy-Duty Stud:
   1. Shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges.

E. Fasteners:
   1. Corrosion resistant coated, self-drilling, self-threading steel drill screws complying with ASTM C1513.

F. Non-Loadbearing Framing Accessories:
   1. Sill Sealer: Closed-cell polyethylene foam, 1/4 inch thick by width of plate.

### 2.03 METAL SUSPENSION SYSTEM

A. All system components conform to ASTM standards.

B. Fire-Resistance Rating: UL approved metal suspension system.

C. Seismic Standard: Acoustical ceilings shall be designed and installed to withstand effects of earthquake motions according to following requirements:
   1. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's 'Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings-Seismic Zones 0-2' (Apply to Seismic Categories A & B).
   2. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's 'Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies-Seismic Zones 3 & 4' (Apply to Seismic Categories C, D, E & F).
   3. Seismic Design Categories D, E and F:
      a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E580/E580M.
      b. Meet seismic bracing requirements of ASCE 7, ASTM C635/C635M and ASTM C636/C636M or equivalent governing standard for project site.

D. Manufacturers:
   1. Acceptable Systems:
      a. Drywall Grid by Armstrong World Industries, Lancaster, PA www.armstrongceilings.com.
      b. Drywall Grid System by Chicago Metallic Corporation, Chicago, IL www.chicagometallic.com.
      c. Drywall Suspension System - Flat Ceilings by USG, Chicago, IL www.usg.com.
      d. Equal as approved by Architect before bidding. See Section 01 6000.

E. Components:
   1. Main Runners/Tee and Cross Runners/Tee:
      a. Heavy-duty in accordance with ASTM C635/C635M.
      b. Cold-formed from ASTM A653/A653M, CS Type B steel and hot dipped galvanized G-40 coating for interior ceilings.
      c. Double-Web construction.
   2. Wall Track/Molding.
   3. Fasteners:
      a. Nails are not permitted when subjected to direct tension such as installed vertically into bottom of structural member.
      b. Metal attachment:
         1) Acoustical Eye Lag Screws:
            (a) 1/4 inch (6.4 mm) screws zinc coated with self-drilling or self-piercing sharp point.
      c. Wood attachment:
         1) Acoustical Eye Lag Screws:
            (a) 3 inch (76 mm) x 1/4 inch (6.4 mm) screws zinc coated for wood joists with Type 17 self-drilling point.
      d. Wire Tie to Metal Structural Member attachment:
         1) Wire wrapped to structural member with pigtail knot with three (3) tight wraps within 3 inch (76 mm) length at top connection.
   4. Hanger Wires, Braces, and Ties:
      a. Zinc-Coated, carbon-steel wire meeting requirements of ASTM A641/A641M, Class 1 zinc coating, soft temper.
      b. Size:
         1) Standard size: 12 gauge (0.105 inch) (2.70 mm) galvanized, soft annealed steel wire.
         2) Select wire diameter so its stress is less than yield when loaded at three (3) times hanger design load (ASTM C635/C635M), Table 1, 'Direct Hung') will be

less than yield stress of wire, but provide not less than 12 gauge (0.105 inch) (2.70 mm).

c. Protect with rust inhibitive paint.

5. Seismic Joint Clip:
   a. Required for Seismic Design Categories D, E and F.
      1) Quality Standard Product:
         (a) SJCG by Armstrong.
         (b) Equal as approved by Architect before bidding. See Section 01 6000.
6. Compression Posts/Struts:
   a. Required for Seismic Design Categories D, E and F.
      1) Meet seismic requirements for Project.

**2.04 FABRICATION**

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

**3.02 INSTALLATION OF STUD FRAMING**

A. Comply with requirements of AISI S220.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Verification Of Conditions:
   1. Inspect area receiving suspension system to identify conditions which will adversely affect installation.
      a. Work trades work to be thoroughly dry and complete prior to installation.
      b. Verify weather tightness of area to receive suspension system prior to installation.
   2. Notify Architect of unsuitable conditions in writing.
      a. Do not install suspension system until adverse conditions have been remedied.

**3.03 INSTALLATION**

A. Interface With Other Work:
   1. Coordinate with other Sections to provide blocking necessary for their work.
   2. Coordinate with other Sections for location of blocking required for installation of equipment and building specialties.

B. Framing:
   1. Installation Standard: ASTM C754.
   2. Specifications of Stud Wall Manufacturer shall govern this work unless more stringent requirements are required by Contract Documents.
   3. Install specified sill sealer under sill plates of exterior walls and of acoustically insulated interior walls.
   4. Stiffen metal-framed walls with 3/4 inch (19 mm) 1-1/2 inches (38 mm) cold formed channels placed horizontally approximately 48 inch (1 200 mm) on center and securely attach to each stud.
   5. Similarly reinforce door and window openings at headers with reinforcing channel extending 18 inches (450 mm) minimum each side of opening.
   6. Apply double framing members at openings. Wrap multiple, adjacent framing members with duct tape or otherwise secure to eliminate 'chattering'.
   7. Use grommets at framing penetrations where unsecured items pass through.

### 3.04 CEILING AND SOFFIT FRAMING AND FURRING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

### 3.05 INSTALLATION OF METAL SUSPENSION SYSTEM

A. Interface With Other Work:
   1. All work above ceiling should be completed prior to installing suspended ceiling system including related work including: drywall furring work, acoustical tile, light fixtures, mechanical systems, electrical systems, and sprinklers.

B. General:
   1. Install suspension system in accordance with Manufacturer's written instructions, and in compliance with ASTM installation standard, and applicable codes as required by AHJ with modifications listed below except where Manufacturer's instructions are more stringent:
      a. Main runners/tees hanger wires 48 inches (1 200 mm) on center maximum.
      b. Cross runners/tees hanger wires 24 inches (600 mm) on center maximum.
      c. Do not kink, twist, or bend hanger wires as a means of leveling assembly.
      d. Do not attach suspension system to adjustable folding partition headers.
   2. Hanger Wires:
      a. Install hanger wire to structure as required with necessary on center spacing to support expected ceiling load requirements, following local practices, codes and regulations. Attach with pigtail knot with three (3) tight wraps within 3 inch (76 mm) length at each end.
      b. Provide additional wires at light fixtures, grilles, and access doors where necessary by appropriate method in accordance with industry accepted practice.
      c. Additional Hanger Wires: Wrapped tightly three (3) full turns within 3 inch (76 mm) length to structure and component at locations where imposed loads could cause deflection exceeding 1/360 span.

C. Seismic:
   1. Required for Seismic Design Categories D, E and F:
      a. Installation must be in accordance with ASCE 7.

### 3.06 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

C. Distances between parallel walls shall be 1/4 inch (6 mm) maximum along length and height of wall.

D. Main Runners/Tees:
   1. Installed and leveled to meet IBC requirements to within 1/4 inch (6.4 mm) in 10 foot (3.05 m) with supporting wire taut to prevent any subsequent downward movement of main runners when ceiling loads are imposed.
   2. At curved ceilings, install faceted main beams with same bend at each joint to achieve consistent ceiling arch across entire ceiling.

E. Cross Runners/Tees:
   1. Main runners, or other cross runners, must support cross runners to within 1/32 inch (0.8 mm) of required center-to-center spacing. This tolerance must be noncumulative beyond 12 feet (3.60 m).
   2. Intersecting runners must be installed to form right angle to supporting members.

## 3.07 FIELD QUALITY CONTROL

A. Field Inspections:
   1. Inspect:
      a. Suspended ceiling system.
      b. Hanger wires, braces, ties, anchors and fasteners.
      c. Curved ceiling framing prior to installation of gypsum board.

B. Non-Conforming Work:
   1. Remove and replace defective materials at no additional cost to Owner.

**END OF SECTION**

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**SECTION 09 3000**
**TILING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

### 1.02 REFERENCE STANDARDS

A. A108.21 - Interior Installation of Flowable Hydraulic Cement Underlayment / Self-Leveling Underlayment – 2021.; 2021.

B. A118.16 - American National Standard Specifications for Flowable Hydraulic Cement Underlayment / Self-Leveling Underlayment; 2021.

C. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2019.

D. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 2021.

E. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 1999 (Reaffirmed 2019).

F. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017.

G. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

H. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.

I. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2019.

J. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2019.

K. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.

L. ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 2017.

M. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).

N. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2019.

O. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

P. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

Q. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

R. ASTM C206 - Standard Specification for Finishing Hydrated Lime; 2014 (Reapproved 2022).

S. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018.

U. ASTM C482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste; 2020.

V. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser; 2021.

W. ASTM C627 - Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester; 2018.

X. ASTM F3191 - Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring; 2023.

Y. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2022.

## 1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

B. In addition to agenda items specified in Section 01 3000, review following:
   1. Review installation scheduling, coordination with related work, and placement of tile.
   2. Review Manufacturer’s installation requirements, submittals, and Installers requirements to assure issuance of Manufacturer’s system warranty.
   3. Review surface preparation.
   4. Review water-proofing and crack isolation membrane requirements.
   5. Review tile base installation requirements.
   6. Review floor tile grout thickness requirements.

## 1.04 SUBMITTALS

A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 24 x 24 inches in size illustrating pattern, color variations, and grout joint size variations.
   1. One sample of each type of base tile and trim piece to be used on Project.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

E. Source Quality Control Submittals:
   1. Provide Manufacturer documentation indicating proposed materials will satisfy requirements for Manufacturer's Warranty.

F. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Cleaning and maintenance instructions.
      b. Warranty Documentation:
         1) Include copy of final, executed warranty.
      c. Record Documentation:
         1) Manufacturer's Documentation:
            (a) Source Quality Control Submittal documentation showing materials will satisfy requirements for Manufacturer's Warranty.
            (b) Manufacturer's cut sheets of materials used in installed system.
            (c) Tile color and pattern selections.

## 1.05 QUALITY ASSURANCE

A. Source Of Materials:
   1. Provide materials obtained from one (1) source for each type and color of tile, grout, and setting materials for Manufacturer's system warranty.

B. Installer Qualifications:

1. Company specializing in performing tile installation, with minimum of five years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

**1.07 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. National Contract Suppliers. See Section 01 6000:
   1. Contact following suppliers to procure components of tile assembly:
      a. Daltile And Stone, Salt Lake City, UT:
         1) Project Coordinators:
            (a) Patrick Dohrer and Libby Lockington, (801) 487-9901, fax (801) 487-0345, Patrick.Dohrer@daltile.com or Libby.Lockington@daltile.com - www.daltileproducts.com or www.daltilegreenworks.com.

B. Design Criteria:
   1. General:
      a. Porcelain Tile:
         1) Cove Base with external and internal corner pieces shall be standard grade.
      b. Ceramic Tile:
         1) Tile shall be standard quality, white or off-white body, square or cushion edge, graded in accordance with ANSI A137.1.
         2) Square edge, white body, lug type wall tile. Field wall tile shall have two lugs on each edge to assure uniform joint, approximately 0.040 inch (one mm).
         3) External and internal corner pieces shall be standard grade.
      c. Font Floor And Font Stair Treads: Porcelain mosaic tile with non-slip, non-abrasive surface.
   2. Capabilities:
      a. Porcelain Tile:
         1) Water Absorption when tested in accordance with ASTM C373: 0.1 to 0.5 percent.
         2) Abrasive Wear Resistance when tested in accordance with ASTM C501: 275 minimum.
         3) Breaking Strength when tested in accordance with ASTM C648: 300 lbs minimum.
         4) Bond Strength when tested in accordance with ASTM C482: 200 psi minimum.
         5) Coefficient of Friction: 0.42 minimum as measured by DCOF (Dynamic Coefficient of Friction) AcuTest method and requirements as per ANSI A137.1.

C. Description:
   1. Porcelain Tile:
      a. Floor Tile (Restroom and Serving Area):
         1) Option A (Finish Floor Tile with no slope shown on Contract Documents):
            (a) Tile Size: 12 inches x 12 inches (300 mm x 300 mm).
            (b) Cove Base: 6 inches x 12 inches (150 mm x 300). Cove base outcorner to match.
            (c) Approved Products (See Section 01 6000):
               (1) Harmonist by Daltile.
            (d) Approved Colors (See Section 01 6000):

(1) HM20 Serene.
(2) HM21 Tranquil.

2) Option B (Finish Floor Tile with no slope shown on Contract Documents):
(a) Tile Size: 12 inches x 24 inches (300 mm x 600 mm).
(b) Cove Base: 6 inches x 12 inches (150 mm x 300 mm). Cove base outcorner to match.
(c) Approved Products (See Section 01 600):
(1) Portfolio by Daltile.
(d) Approved Colors (See Section 01 6000):
(1) PF04 Dove Grey.
(2) PF07 Cream.

3) Option C (Finish Floor Tile with slope shown on Contract Documents):
(a) Tile Size: 2 inches (50 mm) square.
(b) Cove Base: 6 inches x 12 inches (150 mm x 300). Cove base outcorner to match.
(c) Approved Products (See Section 01 6000):
(1) Portfolio by Daltile.
(d) Approved Colors (See Section 01 6000):
(1) PF04 Dove Grey.
(2) PF07 Cream.

b. Font Floor Tile and Font Stair Tread:
1) Floor and stair treads:
(a) Tile Size: 2 inches (50 mm) square.
(b) Approved Products (See Section 01 6000):
(1) Keystone Mosaics by Daltile.
(c) Approved Colors (See Section 01 6000):
(1) Floors and Stair Treads: D037 Pepper White.
(2) Font Stair Risers and Safety Strips: D169 Waterfall

2. Ceramic Tile:
a. Wall Tile:
1) Option A (use only with Floor Tile Option A):
(a) Tile Size: 6 inches x 6 inches (150 mm x 150 mm).
(b) Approved Products (See Section 01 6000):
(1) Color Wheel Collection - Classic: Semi-Gloss or Matte by Daltile.
(c) Approved Field Colors (See Section 01 6000):
(1) Option A: 0135 Almond.
(2) Option B: 0100 White.
(d) Approved Accent Colors:
(1) Option A: 0100 White.
(2) Option B: 0135 Almond.

2) Option B (use only with Floor Tile Option B):
(a) Tile Size: 8 inches x 24 inches (200 mm x 600 mm).
(b) Approved Products (See Section 01 6000):
(1) Color Wheel Linear Collection - Classic: Semi-Gloss or Matte by Daltile.
(c) Approved Colors (See Section 01 6000):
(1) Arctic White 0190.

3) Option C (use only with Floor Tile Option C):
(a) Tile Size: 8 inches x 24 inches (200 mm x 600 mm).
(b) Approved Products (See Section 01 6000):
(1) Color Wheel Linear Collection - Classic: Semi-Gloss or Matte by Daltile.
(c) Approved Colors (See Section 01 6000):

(1) Arctic White 0190.

b. Font Wall and Ceiling Tile:
1) Tile Size: 6 inch by 6 inch (150 mm by 150 mm).
2) Ceramic Tile Base: 6 inch (150 mm) high, A3602 bullnose base.
3) Approved Products (See Section 01 6000):
(a) Color Wheel Collection - Classic: Semi-Gloss or Matte by Daltile.
4) Approved Colors (See Section 01 6000):
(a) 0100 White.

## 2.02 SETTING MATERIALS

A. Manufacturer's Contact List:
1. Custom Building Products, Santa Fe Springs, CA www.custombuildingproducts.com.
a. Contact Information: Kolby Colledge, (801) 362-6100, Kolby.Colledge@cbpmail.net.
2. Dal-Tile Corp., Div. of Mohawk Industries, Dallas, TX www.daltile.com.
3. Laticrete International Inc., Bethany, CT www.laticrete.com.
a. Contact Information: Susan Dolata, sldolata@laticrete.com, (203) 859-2069.
4. Mapei Americas Headquarters, Deerfield Beach, FL www.mapei.com.
a. Contact Information: Bart A. Wilde (801) 467-2060 www.bwilde@mapei.com.
5. Schulter Systems L.P., Plattsburgh, NY www.schluter.com.

B. Materials:
1. Mortar Bed:
a. Design Criteria:
1) Portland Cement: Meet requirements of ASTM C150/C150M, Type 1, designation shall appear on bag.
2) Hydrated Lime: Meet Requirements of one of following:
(a) ASTM C206.
(b) ASTM C207, Type S (designation shall appear on bag).
3) Sand: Clean, washed, well-graded, meeting requirements of ASTM C144 with gradation of 100 percent passing No. 8 sieve with not over five (5) percent passing No. 100 sieve.
b. Approved Products:
1) CUSTOM: Quikrete Sand Topping Mix.
2) LATICRETE: 209.
3) MAPEI: 4 to 1.
2. Latex Additive; in lieu of all water:
a. Design Criteria:
1) Meet material specification requirements of ANSI A118.4 or ANSI A118.11.
2) Meet ANSI installation specification requirements of ANSI A108.5.
3) Expansion joints complies with TCA method EJ171.
b. Approved Products:
1) CUSTOM: Thin-Set Mortar Admix.
2) LATICRETE: 3701 Mortar Admix.
3) MAPEI: Planicrete AC.
3. Flowable Hydraulic Cement Underlayment/Self-Leveling Underlayment:
a. Design Criteria:
1) Meet material specification requirements of ANSI A118.16.
b. Approved Products. See Section 01 6000:
1) CUSTOM: TECH TechLevel 150 Self-Leveling Underlayment.
2) LATICRETE: NXT.
3) MAPEI: UltraPlan 2.
4. Underlayment Primer:
a. Design Criteria:
1) Meet material specification requirements of ANSI A118.16.

b. Approved Products. See Section 01 6000:
    1) CUSTOM: TECH TechPrime A Acrylic Primer.
    2) LATICRETE: NXT Primer.
    3) MAPEI: Primer T.

5. Metal Trim:
    a. Approved Products. See Section 01 6200:
        1) Tile / Carpet Junction: Schluter-RENO-AETK.
        2) Tile / Carpet Junction: Profilitec zerotec ZRN.
        3) Font Stair Nosing: Schluter-TREP-B, one inch (25 mm), color G or HB as selected by Architect.
        4) Font / Stair Nosing: ProfiliteStairtec FL or FS as selected by Architect.
        5) Over Expansion Joints In Slabs: Schluter DILEX-BWS, color G, PG, or HB as selected by Architect.
        6) Over Expansion Joints in Slabs: Profilitec coflex CAJ.
6. Joint Sealants:
    a. Interior Ceramic Tile Joints are furnished in Section 07 9213 and installed in Section 09 3013 'Ceramic Tiling' including the following:
        1) Ceramic and paver cove base inside corners.
        2) Ceramic and paver tile joints.
        3) Termination joints in showers and fonts.
    b. Design Criteria:
        1) Meet material specification requirements of ASTM C920, Type S, Grade NS, Class 25, Use T, NT, A, I, M and G, ASTM C1248 and ASTM C0794 properties.
        2) Meets or exceeds TCNA EJ171 Movement Joint Guidelines for Ceramic, Glass & Stone.
    c. Aproved Products. See Section 01 6000:
        1) CUSTOM: 100% Silicone Sealant
        2) LATICRETE: Latasil.
        3) MAPEI: Mapesil.
7. Backer Board Joint Reinforcing: 2 inch (50 mm) wide glass fiber mesh tape.
8. Tile Setting Products:
    a. Use only products of same Manufacturer to validate warranty, unless otherwise acceptable to Ceramic Tile Supplier.
    b. Use only products that meet Mortar Manufacturer’s twenty five (25) year system warranty requirements.
    c. Latex-Portland Cement Mortar For Floors:
        1) Design Criteria:
            (a) Meet ANSI material specification requirements of ANSI A118.4, ANSI A118.11, ANSI A118.15 and ISO C2TES1P1.
            (b) Meet ANSI installation specification requirements of ANSI A108.4 and ISO material specification ISO13007 installation material specification and C2ES1P1 performance requirements for adhesive.
        2) Approved Products. See Section 01 6000:
            (a) CUSTOM: ProLite Tile & Stone Mortar or FlexBond Preimium Crack Prevention Thin-set Mortar.
            (b) LATICRETE: Multimax Lite.
            (c) MAPEI: Keraflex Super.
    d. Latex/Polymer Modified Portland Cement Mortar For Walls:
        1) Design Criteria:
            (a) Meet ANSI material specification requirements of ANSI A118.4, ANSI A118.11, or ANSI A118.15.

(b) Meet ANSI installation specification requirements of ANSI A108.4 or ISO material specification ISO13007 installation material specification and C2ES1 performance requirements for adhesive.

2) Approved Products. See Section 01 6000:
   (a) CUSTOM: ProLite Tile & Stone Mortar or FlexBond Fortified Thin-Set Mortar.
   (b) LATICRETE:Multimax Lite.
   (c) MAPEI: Keraflex Super.

e. Floor Grout (Epoxy):
   1) Design Criteria:
      (a) Meet ANSI material specification requirements of ANSI A118.3.
      (b) Meet ANSI installation specification requirements of ANSI A108.6 and ISO material specification ISO13007 RG.
   2) Approved Color:
      (a) CUSTOM: No. 09 Natural Gray.
      (b) LATICRETE: No. 24 Natural Grey.
      (c) MAPEI Kerapoxy CQ: No. 11 Sahara Beige.
   3) Approved Color (Font Floor only):
      (a) CUSTOM: No. 165 Delorean Gray.
      (b) LATICRETE: No. 78 Sterling Silver.
      (c) MAPEI Kerapoxy CQ: No. 27 Silver.
   4) Approved Products. See Section 01 6000:
      (a) CUSTOM: CEG-Lite 100% Solids Commercial Epoxy Grout.
      (b) LATICRETE: SpectraLOCK PRO Premium Grout.
      (c) MAPEI: Kerapoxy CQ (sanded).

f. Wall Grout (Modified Polymer):
   1) Design Criteria:
      (a) Meet ANSI material specification requirements of ANSI A118.6 or ANSI A118.7.
      (b) Meet ANSI installation specification requirements of ANSI A108.10 or ISO material specification ISO13007 CG2WA.
   2) Color:
      (a) CUSTOM: No. 381 Bright White.
      (b) LATICRETE: No. 44 Bright White.
      (c) MAPEI: No. 00 White.
   3) Approved Products. See Section 01 6000:
      (a) CUSTOM: PolyBlend Non-Sanded Grout or Prism Color Consistent Grout.
      (b) LATICRETE: Permacolor Grout or Permacolor Select.
      (c) MAPEI: Keracolor-U Unsanded Polymer-Modified Grout.

g. Waterproofing Membrane At Restroom Floors and Font:
   1) Design Criteria:
      (a) Meet ANSI installation specification requirements of ANSI A108.10.
      (b) ANSI installation specification requirements not required.
   2) Approved Products. See Section 01 6000:
      (a) Troweled applied, cement based:
         (1) LATICRETE: Hydro Ban Cementitious Waterproofing Membrane.
         (2) MAPEI: Mapelastic 315.
      (b) Liquid applied, latex based:
         (1) CUSTOM: RedGard Waterproofing or Crack Prevention Membrane or FractureFree Crack Prevention Membrane.
         (2) LATICRETE: Hydro Ban or Hydro Ban XP.
         (3) MAPEI: Mapelastic AquaDefense.

h. Crack Isolation Membrane:

1) Design Criteria:
   (a) Meet ANSI installation specification requirements of ANSI A118.12.
   (b) ANSI installation specification requirements not required.
2) Approved Products. See Section 01 6000:
   (a) Flexible, thin, load-bearing, fabric-reinforced:
      (1) CUSTOM: Crack Buster Pro Crack Prevention Mat Underlayment, with Peel & Stick Primer.
      (2) LATICRETE: Fracture Ban 40 with Fracture Ban Primer.
      (3) MAPEI: Mapeguard 2, and Primer SM.
   (b) Liquid applied, latex based:
      (1) CUSTOM: RedGard Waterproofing and Crack Prevention Membrane or FractureFree Crack Prevention Membrane.
      (2) LATICRETE: Hydro Ban or Hydro Ban XP.
      (3) MAPEI: Mapelastic AquaDefense.

i. Stone Thresholds:
   1) Texture and color variation shall be within limits established by Architect's approved sample.
   2) Free of defects that would materially impair strength, durability, and appearance.
   3) Finish: 80 grit exterior hone.
   4) White marble, one (1) piece, 7/8 inch (22 mm) thick by 2 1/2 inches (64 mm) by door opening width. Cross-section to meet handicap accessibility requirements.

C. Mixes:
   1. Mortar Beds:
      a. Floor Mix: One Part Portland Cement, 5 Parts Dry Sand, 4 Part Damp Sand, 1/10 Part hydrated Lime optional.
      b. Wall Mix: One Part portland cement, 5-1/2 to 7 Parts damp sand, 1/2 Part hydrated lime optional.
      c. Font One Part portland cement, 4 Parts damp sand. Use waterproofing admixture. Mix dry then add minimum amount of water.

## PART 3 EXECUTION

### 3.01 INSTALLERS

A. Acceptable Installers:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

### 3.02 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. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

F. Notify Architect in writing if surfaces are not acceptable to install tile:
   1. Do not lay tile over unsuitable surface.
   2. Commencing installation constitutes acceptance of surfaces and approval of existing conditions.

### 3.03 PREPARATION

A. Allow concrete to cure for twenty-eight (28) days minimum before application of mortar bed.

B. Protect surrounding work from damage.

C. Vacuum clean surfaces and damp clean.

D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

E. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

**3.04 INSTALLATION - GENERAL**

A. Interface with Other Work:
   1. Grounds, anchors, plugs, hangers, door frames, electrical, mechanical, and other work in or behind tile shall be installed before tile work is started.

B. Special Techniques:
   1. Install in accordance with following latest TCNA (HB) installation methods:
      a. Flush Concrete Slabs with crack isolation membrane: TCNA F115.
      b. Mortar Bed on Concrete Slab: TCNA F111 with reinforcing.

C. Tolerances:
   1. Plane of Vertical Surfaces:
      a. 1/8 inch in 8 feet (3 mm in 2.450 meters) from required plane shall be plumb and true with square corners.
   2. Variation in Slab Grade:
      a. Plus or minus 1/8 inch (3 mm) in any 10 feet (3.050 m) of floor slab and distance between high point and low point of slab of 1/2 inch (12.7 mm).
      b. Slab Testing Procedure:
         1) Place ends of straightedge on 3/8 inch (10 mm) high shims.
         2) Floor is satisfactory if 1/4 inch (6 mm) diameter steel rod rolled under straightedge will not touch anywhere along 10 foot (3.050 m) length and 1/2 inch (12.7 mm) diameter steel rod will not fit under straightedge anywhere along 10 foot (3.050 m) length.

D. General:
   1. Install tile in pattern indicated:
      a. Align joints when adjoining tiles on floor, base, walls, and trim are same size.
      b. Adjust to minimize tile cutting and to avoid tile less than half size.
      c. Center and balance areas of tile if possible.
   2. Extend tile into recesses and under equipment and fixtures to form a complete covering without interruption:
   3. Maintain heights of tilework in full courses to nearest obtainable dimension where heights are given in feet and inches (meters and millimeters) and are not required to fill vertical spaces exactly.
   4. Install cut tile with cuts on outer edges of field:
      a. Provide straight cuts that align with adjacent materials.
      b. When possible, smooth cut edges of tile or use appropriate cutter or wet saw to produce smooth cuts.
      c. Do not install tile with jagged or flaked edges.
   5. Terminate tile neatly at obstructions, edges, and corners, without disruption of pattern or joint alignment:
      a. Fit tile closely where edges are to be covered by trim, escutcheons, or similar devices.
   6. Provide straight tile joints of uniform width, subject to variance in tolerance allowed in tile size:
      a. Make joints smooth and even, without voids, cracks, or excess mortar or grout.

7. Use a beating block and hammer or rubber mallet so faces and edges of individual tiles are flush and level with faces and edges of adjacent tiles, and to reduce lippage.
8. Accessories in tilework shall be evenly spaced, properly centered with tile joints, and level, plumb, and true to correct projection.
9. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

E. Application on Concrete Floor:
1. On Mortar Bed:
   a. Apply mortar bed to depth equal to depression in slab minus 1/2 inch (12.7 mm).
   b. Properly cure before installing tile.
2. Clean substrate surface thoroughly.
   a. Dampen if very dry, but do not saturate.
3. Install tile with 100 percent contact with mortar bed.
   a. Obtaining 100 percent contact may require troweling mortar layer on back of each tile before placing on mortar bed.
4. Install base by flush method (square or thin-lip method is not acceptable):
   a. Allow for expansion joint directly above any expansion or control joints in slab.
5. Insert temporary filler in expansion joints.

F. Application of Mortar:
1. Do not spread more mortar than can be covered within ten (10) to fifteen (15) minutes:
   a. If 'skinning' occurs, remove mortar and spread fresh material.
   b. Spread mortar with notches running in one (1) direction, perpendicular to pressing, pushing and pulling of tile during placement.
2. Install tile before mortar has started initial cure:
   a. For thin set mortar application, use notch trowel that will achieve the recommended coverage of mortar after tiles have been installed.
3. Place tile in fresh mortar, press, push and pull tile slightly to achieve as near 100 percent coverage and contact of tile with setting material and substrate as possible:
   a. Average contact area shall be not less than eighty (80) percent except on exterior or shower installations where contact area shall be ninety-five (95) percent when not less than three (3) tiles or tile assemblies are removed for inspection. The eighty (80) percent or ninety-five (95) percent coverage shall be sufficiently distributed to give full support of the tile.
   b. Support corners and edges with mortar leaving no hollow corners or edges.
4. Install so there is 1/8 inch (3 mm) of mortar between tile and substrate after proper bedding:
   a. Periodically remove sheets or individual tiles to assure proper bond coverage consistent with industry specifications.
   b. If coverage is found to be insufficient, use a larger size notch trowel.

G. Application of Grout:
1. Firmly set tile before applying grout:
   a. This requires forty-eight (48) hours minimum.
2. Before grouting:
   a. Remove all paper and glue from face of mounted tile.
   b. Remove spacers or ropes before applying grouting:
3. Mixing Grout:
   a. Use clean buckets and mixing tools:
      1) Use sufficient pressure and flow grout in progressively to avoid air pockets and voids.
   b. Machine mixing of grout is preferred to assure uniform blend. To prevent trapping air bubbles into prepared grout, use slow speed mixer.
   c. Slake for fifteen (15) minutes.
   d. Water or latex additives used for mixing with dry grout shall be measured accurately.

4. Before grouting entire area, do a test area to assure there will be no permanent staining or discoloration of tile and to verify that excess grout can be easily removed from tile surface:
    a. If necessary, pre-coat exposed surfaces of tile with a grout release recommended by Grout Manufacturer to facilitate removal of excess grout.
5. Installing Grout:
    a. Use caution, when grouting glazed ceramic tiles to prevent scratching or damaging surface of tile.
    b. Dampen dry joints prior to grouting with sand-portland cement grout, standard sanded cement grout, standard unsanded cement grout, polymer modified sanded tile grout, and polymer modified unsanded tile grout. Do not leave puddles of water in joints before grouting.
    c. Keep an adequate joint depth open for grouting. Force maximum amount of grout into joints.
    d. Apply grout to produce full, smooth grout joints of uniform width, and free of voids and gaps
        1) Fill joints of cushion edge tile to depth of cushion.
        2) Fill joints of square edge tile flush with surface.
        3) Fill joint between wall tile and bull-nosed paver tile base with floor grout.
    e. Install floor tile with grout thickness of 3/16 inch (4.76 mm) maximum.
    f. Remove excess grout from surface of tile before it loses its plasticity or begins to set.
    g. Finished grout shall be uniform in color, smooth, and without voids, pin holes, or low spots.

H. Curing:
1. Keep installation at 65 to 85 deg F (18 to 30 deg C) during first eight (8) hours of cure. Shade area completely from sun during this period.

I. Application of Joint Sealants:
1. Apply joint sealants after grout has cured:
    a. This requires forty-eight (48) hours minimum.
2. Before applying sealant:
    a. Remove spacers or ropes before applying joint sealants.
    b. Apply backer rod and joint sealants at expansion joints.

## 3.05 FIELD QUALITY CONTROL

A. Non-Conforming Work:
1. Correct any work found cracked, chipped, broken, unbounded and otherwise defective or not complying with contract document requirements at no additional cost to the Owner.

## 3.06 CLEANING

A. Clean tile and grout surfaces.

B. If one has been used, remove grout release and clean tile surfaces so they are free of grout residue and foreign matter:
1. If a grout haze or residue remains, use a suitable grout haze remover or cleaner.
2. Flush surface with clean water before and after cleaning.

## 3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

B. Close to traffic areas where tile is being set and other tile work being done:
1. Keep closed until tile is firmly set.
2. Before, during, and after grouting, keep area clean, dry, and free from foreign materials and airflow that will interfere with setting and curing of grout.

C. Newly tiled floors shall not be walked on nor worked on without using kneeling boards or equivalent protection of tiled surface.

D. After cleaning, provide protective covering and maintain conditions protecting tile work from damage and deterioration:
   1. Where tiled surfaces will be subject to equipment or wheel traffic or heavy construction traffic, cover protective covering with 1/4 inch (6 mm) hardboard, plywood, or similar material.

**END OF SECTION 09 3000**

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**SECTION 09 5100**
**ACOUSTICAL CEILINGS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

### 1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASHRAE Std 62.1-2013 - Ventilation for Acceptable Indoor Air Quality 2013.

C. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low- Alloy, Hot-Rolled and Cold-Rolled, General Requirements for 2019a.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

F. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2022.

G. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.

H. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.

I. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces 2008 (Reapproved 2019).

J. ASTM D1779 - Standard Specification for Adhesive for Acoustical Materials 1998.

K. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

M. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.

N. 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 2022.

O. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2016.

P. ASTM E1111/E1111M - Standard Test Method for Measuring the Interzone Attenuation of Open Office Components 2014 (Reapproved 2022).

Q. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

R. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum 2021a.

S. ASTM E1477 - Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers 1998a (Reapproved 2022).

T. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls 2019.

V. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

## 1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Participate in pre-installation conference specified in Section 09 2900 to review finish requirements for gypsum wallboard ceilings.
   2. Schedule acoustical tile ceiling pre-installation conference after installation of gypsum wallboard but before beginning installation of tile.
   3. In addition to items specified in Section 01 3100, review following:
      a. Verify that tile comes from same dye lot and has same dye lot code.
      b. Review requirements of acceptable and non-acceptable tile.

B. 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.

C. Do not install acoustical units until after interior wet work is dry.

D. Coordination:
   1. Coordinate layout of suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and fire-suppression systems.
   2. All work above ceiling should be completed prior to installing suspended system. There should be no materials resting against or wrapped around suspension system, hanger wires or ties.

## 1.04 SUBMITTALS

A. Product Data: Provide data on suspension system components and acoustical units.

B. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

C. One (1) sample of each variant of specified tile series.

D. Minimum 8 inch (200 mm) long samples of exposed wall molding and suspension system, including main runner/tee and cross runner/tee with couplings.

E. Manufacturer's certifications that products comply with specified requirements including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry approved independent laboratory classification of NRC, CAC, and AC.

F. Certificates:
   1. Installer(s):
      a. Provide each Installer’s ‘Certificate of Completion - Duratile’ from Manufacture showing Name and completion date with bid to be included in closing documents for project.
         1) Certificate is valid for two (2) years from date printed on Certificate before recertification is required.
   2. Suspension Assemblies:
      a. Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
      b. Installer’s certificates of training.

G. If requested by Owner, provide copies of Quality Assurance requirements for ‘Class A’ flame spread rating and 'Room-Corner Test'.

H. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

I. Closeout Submittals:

1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    a. Warranty Documentation:
        1) Final, executed copy of Warranty.
    b. Record Documentation:
        1) Manufacturers Documentation:
            (a) Manufacturer's literature.
            (b) Color and pattern selection.
2. Installer(s) 'Certificate of Completion - Duratile' submitted at time of bid.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Acoustical Units: Provide Owner with two (2) cartons of each pattern and color used on Project for future use.
    a. Packaged with protective covering for storage and identified with appropriate labels.
2. Acoustical Tile: Provide Owner with six (6) cartons of each type of tile with same dye lot code.

**1.05 QUALITY ASSURANCE**

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Regulatory Agency Sustainability Approvals:
1. All system components conform to ASTM standards.
2. Fire-Resistance Rating: UL approved metal suspension system.

C. Acoustical Panel Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Acoustical Tile Unit Manufacturer Qualifications:
1. Installer: Requirements of Section 01 4301 applies, but not limited to following:
    a. Minimum five (5) years satisfactorily completed projects of comparable quality, similar size, and complexity including a minimum of three (3) years of experience in glue-up ceiling tile installations and shall have satisfactorily completed glue-up installation(s) within in past three (3) years before bidding.
    b. Review, understand, and comply Installer Qualifications and submitted 'Duratile' published installation recommendations provided by Manufacturer:
        1) Contact Armstrong CSA customer service center at (800) 442-4212 to obtain and review compliance package on Duratile prior to bidding.
        2) This requirement may be waived by Owner, if Installer has previously complied with Installer Qualification requirements and can document at least two (2) satisfactorily completed projects of comparable size using Armstrong 12 inch x 12 inch (300 mm x 300 mm) ceiling tile for glue-up within past three (3) years prior to bidding.
        3) Installer shall note complete compliance with Qualification requirements on submitted bid form.
        4) Submit qualification documentation unless waived by Owner.
    c. Agree to complete and pass 'Duratile Personal Learning Module' (Certificate required for all Installer(s) for Church projects). Certification valid for two (2) years:
        1) Go to http://www.armstrong.com/commceilingsna/#.
        2) Click on My Armstrong Upper Right hand Corner.
        3) First time users: Click on 'Register' button and provide all appropriate information for username and password (you must register as a contractor to have access to 'ELearning System).
        4) Under My Armstrong Functions (left hand side), click on 'ELearning System'.
        5) Click on 'Duratile Video'.
        6) Watch video and take Quiz (10 questions). Passing grade required for certificate.
        7) Print Certificate.

8) Certificate must be submitted with Bid.
9) Submit ‘Certificate of Completion - Duratile’. Required for all projects and may not be waived by Owner.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A. Delivery and Acceptance Requirements:
1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
1. Store materials where protected from moisture, direct sunlight, surface contamination, and damage.
2. Store in cool, dry location, out of direct sunlight and weather, and at temperatures between 32 deg F (0 deg C) and 86 deg F (30 deg C).
3. Store adhesive on site at installation temperature, between 65 and 90 deg F (18 and 32 deg C), for one week before installation.
4. Handle acoustical ceiling panels carefully to avoid chipping edges or damage. Use no soiled, scratched, or broken material in the Work.

**1.07 FIELD CONDITIONS**

A. Ambient Conditions:
1. Building shall be enclosed, mechanical system operating with proper filters in place, and temperature and humidity conditions stabilized within limits under which Project will operate before, during, and after installation until Substantial Completion.
2. Installation shall be at temperatures between 50 deg F (10 deg C) and 86 deg F (30 deg C) or as per Manufacturer recommendations.

B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

**1.08 WARRANTY**

A. Acoustical Ceiling Panels:
1. Manufacturers warranty to be free from defects in material and factory workmanship.
2. Manufacturer's warranty against sagging and warping.
3. Manufacturer's warranty against mold/mildew and bacterial growth.

B. Acoustical Tile:
1. Provide manufacturer's ten (10) year limited system warranty for the following:
a. Manufacturer's warranty to be free from defects in material and factory workmanship.
b. Manufacturer's warranty against sagging and warping.
c. Manufacturer's warranty against mold/mildew and bacterial growth.

C. Suspension Assemblies:
1. Manufacturer warranty including repair or replacement of rusting as defined by ASTM D610 and defects in material or factory workmanship.

**PART 2 PRODUCTS**

**2.01 REGULATORY AGENCY SUSTAINABILITY APPROVALS**

A. Fire-Test-Response Characteristics: As determined by testing identical ceiling tile applied with identical adhesives to substrates according to test method indicated below by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Surface-Burning Characteristics:
a. Ceiling tile shall have Class A flame spread rating in accordance with ASTM E84 or UL 723 Type 1.
1) Class A (Flame spread index 0-25; Smoke-developed index 0-450).
2) Flash point: None.

B. Passage of ‘Room-Corner Test' as recognized by AHJ, is required for system. Adhesive cited in test literature is required for installation of ceiling tile on Project.

1. Room Corner Tests:
    a. ASTM E84, ‘Standard Test Method for Surface Burning Characteristics of Building Materials'.
    b. IBC 803.2.1, ‘Room Corner Test for Interior Wall or Ceiling Finish Materials’.
    c. NFPA 265: ‘Room Corner Test for Interior Wall or Ceiling Finish Materials’.
    d. UL 723, ‘Standard for Safety Test for Surface Burning Characteristics of Building Materials'.

C. All system components conform to ASTM standards.

D. Fire-Resistance Rating: UL approved metal suspension system.

E. Meet seismic bracing requirements of ASCE 7, ASTM C635/C635M and ASTM C636/C636M or equivalent governing standard for project site.

F. Seismic Standard: Acoustical ceilings shall be designed and installed to withstand the effects of earthquake motions according to the following:
    1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E580/E580M.
    2. CISCA’s Recommendations for Acoustical Ceilings: Comply with CISCA’s ‘Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings-Seismic Zones 0-2’ (Apply to Seismic Categories A & B).
    3. CISCA’s Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA’s ‘Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies-Seismic Zones 3 & 4’ (Apply to Seismic Categories C, D, E & F).

## 2.02 MANUFACTURERS

A. Acoustic Ceiling Panels: Manufacturers Contact List:
    1. Armstrong World Industries, Lancaster, PA www.ceilings.com.
        a. Contact Information:
            1) For pricing and ordering of tile, contact Sherry Brunt / Phyllis Miller at (800) 442-4212, FAX 800-233-5598, or bpo_strategic_accounts@armstrong.com.
            2) For Strategic Account information, contact Randy Lay at (303) 775-1409 ralay@armstrong.com.

B. Acoustic Tile: Manufacturers:
    1. Manufacturer Contact List:
        a. Armstrong World Industries, Strategic Accounts, Lancaster, PA www.ceilings.com.
            1) For pricing and ordering of tile, contact Sherry Brunt, Phyllis Miller, or Beth Rinehart at (800) 442-4212, or Armstrongcsa@armstrong.com.
            2) For Strategic Account information, contact Deborah Pickens at (480) 695-9053 dlpickens@armstrong.com.
        b. Franklin International, Inc., Columbus, OH www.titebond.com.

## 2.03 ACOUSTICAL PANEL UNITS

A. Acoustic Ceiling Panels:
    1. Description:
        a. Color: White (surface factory-applied).
        b. Composition: Wet-formed mineral fiber.
    2. Design Criteria:
        a. Acoustics:
            1) Noise Reduction Coefficient (NRC): ASTM C423; 0.70 minimum.
            2) Ceiling Attenuation Class (CAC): ASTM E1414/E1414M; 35 minimum.
        b. Antimicrobial Protection: Resistance against growth of mold/mildew.
        c. Classification:
            1) Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form 1 (nodular) or Form 4 (cast or molded), Pattern E1 (lightly textured).
        d. Fire Performance: As specified in Quality Assurance in Part 1 of this specification.

e. Light Reflectance (LR): ASTM E1477; 0.83 minimum.
f. Sag Resistance: Resistance to sagging in high humidity conditions.
g. VOC: Low.

B. Wide Face Design:
1. Design Criteria:
a. Grid Face: 15/16 inch (24 mm).
b. Size: 24 inch x 24 inch x 3/4" (610 mm x 610 mm x 19 mm).
c. Edge profile: Square.
2. Acceptable Product:
a. Fine Fissured item 1713 by Armstrong:
1) Grid System: Prelude XL Exposed Tee.
2) Edge Profile: Square Lay-in.
b. Radar ClimaPlus Open Plan item 22320 by USG:
1) Grid System: DX/DXL Exposed Tee.
2) Edge Profile: Square.
c. Equal as approved by Architect before bidding. See Section 01 6200.

## 2.04 ACOUSTICAL TILE UNITS

A. Materials:
1. Description:
a. Size: 3/4 inch (19 mm) thick minimum by 12 inches (300 mm) square.
b. Color: White.
c. Grid Face: Tile glue-up.
d. Surface Finish: Factory-applied.
e. Wet-formed high density mineral fiber.
2. Design Criteria:
a. Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form water felted), Pattern CE (perforated, small holes – lightly textured), Fire Class A.
b. Acoustics:
1) Noise Reduction Coefficient (Rating expressed according to ASTM E1284 requirements:
(a) NRC rating: 60 minimum.
2) CAC rating: 35 minimum.
c. Anti Mold / Mildew:
1) Resistance against growth of mold/mildew.
d. Durable:
1) Impact-resistant.
2) Scratch-resistant.
e. Tongue and Groove.
f. Finish:
1) Abuse-resistant/durable, factory applied vinyl latex paint.
g. Fire Performance:
1) Panels meet ASTM E84 or UL 723 Type 1 surface burning characteristics.
h. High Recycled Content (HRC): Classified as containing greater than 50 percent total recycled content.
i. Light Reflectance (LR): 0.86 Average (Range of 0.84 to 0.88).
j. Sag Resistance:
1) Resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.
k. Texture: Embossed texture with fine fissuring and small perforations with natural variation in texture and color appearance between tile.
l. VOC Emissions:

1) Low formaldehyde: Contributing less than 13.5 ppb in typical conditions per ASHRAE Standard 62, 'Ventilation for Acceptable Indoor Air Quality'.

3. Approved Products. See Section 01 6200:
   a. Duratile Item No. MN80377 by Armstrong.

**2.05 ACOUSTICAL TILE UNITS (TYPE F)**

A. Materials:
1. Description:
   a. Size: 3/4 inch (19 mm) thick minimum by 12 inches (300 mm) square.
   b. Color: White.
   c. Grid Face: Tile glue-up.
   d. Surface Finish: Factory-applied.
   e. Wet-formed high density mineral fiber.
2. Design Criteria:
   a. Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form water felted), Pattern CE (perforated, small holes – lightly textured), Fire Class A.
   b. Acoustics:
      1) Noise Reduction Coefficient (Rating expressed according to ASTM E1284 requirements:
         (a) NRC rating: 60 minimum.
      2) CAC rating: 35 minimum.
   c. Anti Mold / Mildew:
      1) Resistance against growth of mold/mildew.
   d. Durable:
      1) Impact-resistant.
      2) Scratch-resistant.
   e. Tongue and Groove.
   f. Finish:
      1) Abuse-resistant/durable, factory applied vinyl latex paint.
   g. Fire Performance:
      1) Panels meet ASTM E84 or UL 723 Type 1 surface burning characteristics.
   h. High Recycled Content (HRC): Classified as containing greater than 50 percent total recycled content.
   i. Light Reflectance (LR): 0.86 Average (Range of 0.84 to 0.88).
   j. Sag Resistance:
      1) Resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.
   k. Texture: Embossed texture with fine fissuring and small perforations with natural variation in texture and color appearance between tile.
   l. VOC Emissions:
      1) Low formaldehyde: Contributing less than 13.5 ppb in typical conditions per ASHRAE Standard 62, 'Ventilation for Acceptable Indoor Air Quality'.
3. Approved Products. See Section 01 6200:
   a. Duratile Item No. MN80377 by Armstrong.

**2.06 ACOUSTICAL CEILING UNITS (TYPE G)**

A. Acoustic Ceiling Panels:
1. Description:
   a. Size: 3/4 inch (19mm) thick, 24" X 24".
   b. Color: White (surface factory-applied).
   c. Composition: Formed mineral fiber.
2. Design Criteria:
   a. Acoustics:
   b. Noise Reduction Coefficient (NRC): ASTM C423; 0.55 minimum.

c. Ceiling Attenuation Class (CAC): ASTM E1414/E1414M; 33 or 35 minimum.
d. Antimicrobial Protection: Resistance against growth of mold/mildew.
e. Classification:
f. Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form 1 (nodular) or Form 4 (cast or molded), Pattern E1 (lightly textured).
g. Fire Performance: As specified in Quality Assurance in Part 1 of this specification.
h. Light Reflectance (LR): ASTM E1477.
i. White panel: ASTM E 1477; 0.85 minimum..
j. Sag Resistance: Resistance to sagging in high humidity conditions.
k. VOC: Low.

B. Wide Face Design:
1. Acceptable Product:
a. Fine Fissured item 1717 by Armstrong:
1) Grid System: Prelude XL Exposed Tee.
2) Edge Profile: Angled Tegular.

**2.07 ACCESSORIES:**

A. Adhesive:
1. Description:
a. For use on acoustical ceiling tiles.
2. Design Criteria:
a. Meet requirements of ASTM D1779.
b. Meet NFPA Class A fire rating when tested in accordance with ASTM E84.
c. Fast grab and ‘no sag’ installation.
d. Water cleanup.
e. Not recommended for use on tiles larger than 12 inch x 12 inch (305 mm x 305 mm).
3. Acceptable Products:
a. Titebond No. 2704 Solvent Free Acoustical Ceiling Tile Adhesive by Franklin International.
b. Highest quality of adhesive from manufacturer recommended by Tile Manufacturer as approved by Architect before use. See Section 01 6200.

B. Edge Molding:
1. Steel 'U' molding with baked enamel finish.
2. Acceptable Products:
a. 7843 Series by Armstrong.
b. Equal as approved by Architect before installation. See Section 01 6200.

**2.08 SUSPENSION SYSTEM(S)**

A. Manufacturers:
1. Acceptable Manufacturers. See Section 01 6000:
2. Acceptable Manufacturers:
a. Silhoutte XL ¼ inch Reveal
1) Armstrong World Industries Co, Lancaster, PA www.armstrong.com.
2) Equal as approved by Architect before bidding. See Section 01 6000.

B. Materials:
1. Grid:
a. Systems shall meet requirements of ASTM C635/C635M, Intermediate Duty suspension system required for Seismic Design Categories A, B, or C.
b. Systems shall meet requirements of ASTM C635/C635M, Heavy Duty suspension system required for Seismic Design Categories D, E, or F.
c. Exposed surfaces shall be finished with factory-applied white baked enamel.
d. Meet requirements of ASTM D610 for red rust.
e. Main runners and cross tees:

1) All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A653/A653M. Main beams and cross tees are double-web steel construction with type exposed flange design.
2) Wide-face design – main notched runners and slotted cross tees shall have 9/16 inch exposed face.

2. Performance Standards:
3. Wire Hangers, Braces, and Ties:
   a. Zinc-Coated, carbon-steel wire meeting requirements of ASTM A641/A641M, Class 1 zinc coating, soft temper.
   b. Size:
      1) Standard size: 12 gauge (0.105 inch) (2.70 mm) galvanized, soft annealed steel wire.
      2) Select wire diameter so its stress is less than yield when loaded at three (3) times hanger design load (ASTM C635/C635M), Table 1, 'Direct Hung') will be less than yield stress of wire, but provide not less than 12 gauge (0.105 inch) (2.70 mm).
   c. Protect with rust inhibitive paint.
4. Wall Molding: Channel section of cold-rolled electro-galvanized steel.
5. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of same width as exposed runner.
6. Hold-down Clips: As required by UL to prevent lifting of panels under unusual draft conditions.
7. Seismic Joint Clip:
   a. Required for Seismic Design Categories D, E, or F.
   b. Quality Standard Product:
      1) SJCG by Armstrong World Industries, Lancaster, PA www.armstrong.com.
      2) Equal as approved by Architect before bidding. See Section 01 6000.
8. Seismic Suspension System:
   a. Required for Seismic Design Categories A, B, C, D, E, or F:
   b. Design Criteria:
      1) Installation of ceiling system must be as prescribed by ICC-ES Evaluation Reports ESR-1222 or ESR-1308 and applicable code.
      2) Meet requirements of ASTM A568/A568M for hot-dipped galvanized, cold-rolled steel.
      3) Attach cross runners to wall with seismic clips.
   c. Wall Molding Size: 15/16 inch (22 mm) for all seismic design categories (code approved).
   d. Acceptable Products. See Section 01 6000.
      1) BERC-2 Clip by Armstrong World Industries, Lancaster, PA www.ceilings.com.
9. Compression Posts/Struts:
   a. Required for Seismic Design Categories D, E, or F.
   b. Meet seismic requirements for Project.

**2.09 ACCESSORIES:**

A. Adhesive:
   1. Description:
      a. For use on acoustical ceiling tiles.
   2. Design Criteria:
      a. Meet requirements of ASTM D1779.
      b. Meet NFPA Class A fire rating when tested in accordance with ASTM E84.
      c. Fast grab and 'no sag' installation.

d. Water cleanup.
e. Not recommended for use on tiles larger than 12 inch x 12 inch (305 mm x 305 mm).

3. Acceptable Products:
   a. Titebond No. 2704 Solvent Free Acoustical Ceiling Tile Adhesive by Franklin International.
   b. Highest quality of adhesive from manufacturer recommended by Tile Manufacturer as approved by Architect before use. See Section 01 6200.

B. Edge Molding:
1. Steel 'U' molding with baked enamel finish.
   a. Acceptable Products:
      1) 7843 Series by Armstrong.
      2) Equal as approved by Architect before installation. See Section 01 6200.

C. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

D. Perimeter Moldings: Same metal and finish as grid.

E. Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.

F. 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 that layout of hangers will not interfere with other work.

C. Inspect for defects in backing and support that are not acceptable.
1. Examine areas around HVAC diffusers and light fixtures for tile installation problems.
2. Examine ceiling for levelness. CISCA ‘Code of Practice’ requires ceiling to be free of irregularities and be level to within 1/4 inch (6 mm) in 12 foot (305 mm).
3. Examine substrate for any problems that will compromise adhesion of ceiling tile.

D. Inspect for defects in support that are not acceptable.
1. All wet work (concrete, painting, and etc.) must be completed and dry.
2. Temperature conditions within Manufacturer’s written recommendation.
3. Verify weather tightness of area to receive suspension system prior to installation.

E. Notify Architect of unsuitable conditions in writing.
1. Do not install acoustical ceiling panels until defects in support or environmental conditions are corrected.
2. Do not apply ceiling tile until defects in backing and support are corrected.

### 3.02 PREPARATION

A. Materials shall be dry and clean at time of application.

B. Follow Manufacturer recommendations for surface preparation:
1. Substrate must be clean, free of grease and dirt, sound, smooth, even and level before applying tile to surface.
2. Painted Surfaces: Avoid applying tile to newly painted ceiling.
3. Materials shall be dry and clean at time of application.

C. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

### 3.03 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. Individual component deflection not to exceed 1/360 of span.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Locate system on room axis according to reflected plan.

E. Lay out suspension system symmetrically about center lines of room unless shown otherwise by Contract Drawings. Lay out system so use of tiles less than 1/2 size is minimized.

F. Suspend main runner/tee from overhead construction with hanger wires spaced 4 feet (1.20 m) on center along length of main runner/tee. Install hanger wires plumb and straight. Hanger wires shall not be installed in convenience holes.

G. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

H. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

I. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

J. Suspend main runner/tee from overhead construction with hanger wires spaced 4 feet (1.20 m) on center along length of main runner/tee. Install hanger wires plumb and straight. Hanger wires shall not be installed in convenience holes.

K. 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.

L. 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.

M. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

N. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

O. Do not eccentrically load system or induce rotation of runners.

P. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.
   3. Overlap and rivet corners or install corner caps.

Q. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

R. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

S. Do not attach suspension system to adjustable folding partition headers.

T. Screws, eyebolts or lag bolts used to support metal acoustical suspended assemblies must have minimum embedment of 5/8 inch (15.9 mm) when installed into structural members.

U. Nails installed vertically into bottom of structural members, which are subject to pullout, shall not be used to support metal acoustical suspended assemblies:

V. Nails may be used when installed horizontally into sides of structural members.

W. Embedment must be at least 5/8 inch (15.9 mm).

**3.04 INSTALLATION - ACOUSTICAL TILE UNITS**

A. Special Techniques:
   1. Installation shall be in accordance with Manufacturer's recommendations:
      a. Do not install tile when room temperature exceeds or below recommended ambient conditions.
      b. Tile is directional tile and must be installed in same direction of pattern running parallel to long dimension of each room.
      c. Remove loose dust from back of tile and ceiling where adhesive is to be applied.
      d. Prime 3 inch (75 mm) minimum circle near each corner by buttering very thin coat of adhesive.
      e. Apply daub of adhesive to each corner. Daubs will be of sufficient size to form a circle 2-1/2 to 3 inches (63 to 75 mm) in diameter and 1/8 to 1/4 inch (3 to 6 mm) thick when tile is pressed firmly in place. Do not apply daubs so far in advance of installation that adhesive skins over.
      f. Tile are to have same color run number, do not bend tile during installation.
   2. Tile Layout:
      a. Lay out tile symmetrically about center lines of room.
      b. Lay out so tiles at room perimeters are at least 1/2 full tile size.
      c. Leave tile in true plane with straight, even joints.
      d. Tile joints shall be straight and in alignment, and exposed surface flush and level.
      e. Furnish and install specified molding wherever tile has exposed edges or abuts walls, columns, and other vertical surfaces, except at curves of 3 inch (75 mm) radius or smaller.
      f. Cut around penetrations that are not to receive moldings cleanly with sharp knife and at a slight angle away from cutout.
   3. Ceiling mounted items:
      a. Locate light fixtures, speakers, and mechanical diffusers and grilles symmetrically in room and centered on tile centers or tile joints insofar as possible, unless shown otherwise.
      b. Keep method of locating ceiling mounted items as consistent as possible throughout building.
      c. Ceiling mounted item location method within each room shall always be consistent.

**3.05 INSTALLATION - ACOUSTICAL PANEL UNITS**

A. Install acoustical units in accordance with manufacturer's instructions.

B. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

C. Special Techniques:
   1. If recommended by Manufacturer, use tile one at a time from at least four (4) open boxes to avoid creating any pattern due to slight variations from box to box. Use tile from same color run in individual rooms to assure color match.
   2. Leave tile in true plane with straight, even joints.

D. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

E. Lay directional patterned units with pattern parallel to longest room axis.

F. Fit border trim neatly against abutting surfaces.

G. Install units after above-ceiling work is complete.

H. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

I. 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.

J. Where round obstructions occur, provide preformed closures to match perimeter molding.

K. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.

## 3.06 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.

## 3.07 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Acoustical Tile. The following have been identified by the Manufacturer as tile defects, should not be installed, and will be replaced at no charge to Owner. Manufacturer will replace any material that does not meet product specifications. Installer to call 1 (800) 442-4212 immediately to report any tile discrepancies:
      a. Obvious Tile Defects:
         1) Gross surface defects or damage.
         2) Gross damage to edges and corners.
         3) Bevels without paint.
      b. Size Measurement:
         1) Tiles measure 12 inches (305 mm), plus or minus 1/32 inch (0.8 mm), measured across center of two (2) parallel sides.
      c. Squareness Measurement:
         1) Measure two (2) diagonals of an individual ceiling tile.
         2) Diagonal measurements need to be within 1/16 inch (1.6 mm) of each other. No more than 1/16 inch (1.6 mm) difference.
      d. Warp:
         1) Tiles specification is plus or minus 0.050 inch (1.27 mm) as measured in the center of tile.
   2. Installer:
      a. Substrate preparation and installation of ceiling tile not following CISCA Code of Practice will be unacceptable and considered defective and subject to replacement at no cost to Owner.

B. Non-Conforming Work:
   1. Suspension Assemblies:
      a. Field Inspections:
         1) Inspect:
            (a) Suspended ceiling system.
            (b) Hangers, anchors and fasteners.
         2) Correct any work found defective or not complying with contract document requirements at no additional cost to Owner.

C. Non-Conforming Work:
   1. Acoustical Panels: Remove and replace defective materials at no additional cost to Owner including, but not limited to following:
      a. Remove and replace damaged or broken acoustical ceiling panels.
      b. Remove and replace discolored acoustical ceiling panels to match adjacent.
      c. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

## 3.08 ADJUSTING

A. 'Touch-up' minor abraded surfaces.

## 3.09 CLEANING

A. Clean exposed surfaces of acoustical ceiling panels, including trim, edge moldings, and suspension members.

1. Comply with Manufacturer's written instructions for cleaning and touch up of minor finish damage.

B. Waste Management:
   1. Remove from site all debris connected with work of this Section.

**END OF SECTION**

**SECTION 09 6466**
**WOOD ATHLETIC FLOORING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Wood athletic flooring.

### 1.02 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

### 1.03 REFERENCE STANDARDS

A. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate completion of flooring installation with other trades.

B. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 09 0561 and held jointly with Section 09 6466 pre-installation conference.
   2. Conference may be held at project site or another convenient site. Participants may also attend by video or audio conference if approved by Project Manager.
   3. Schedule conference after substrate preparation and ONE (1) week minimum before installation of flooring system.
   4. In addition to agenda items specified in Section 01 3000 and Section 09 0561, review following:
      a. Review Testing Agency testing report of Alkalinity and Concrete Moisture of concrete slab:
         1) Follow Testing Agency report regarding Alkalinity and Concrete Moisture of concrete slab as specified in Section 09 0561 - Common Work Results for Flooring Preparation.
      b. Review schedule for installation of wood athletic flooring and coordination with other trades.
      c. Review Flooring Manufacturer's installation conditions verification procedure and requirements.
      d. Review Building Ambient Conditions including normal levels of humidity, lighting, heating, and air conditioning for acceptability for beginning floor preparation and flooring installation.
      e. Review high moisture remediation options when high moisture exists based on moisture testing specified in Section 09 0561 - Common Work Results for Flooring Preparation.

C. Scheduling:
   1. Testing Agency to provide testing for Alkalinity and Concrete Moisture of concrete slab as specified in Section 09 0561 - Common Work Results for Flooring Preparation.
   2. Notify Flooring Installer when Building Ambient Conditions requirements are met before installation of flooring system.

### 1.05 SUBMITTALS

A. Product Data: Provide data for flooring, floor finish materials, resilient cushion, and acoustic underlayment.

B. Moisture Suppression Membrane Underlayment
   1. Provide product literature or cut sheet on underlayment.

C. Wood Athletic Flooring:
   1. Manufacturer's literature or cut sheet for flooring system and for finish system.
   2. Maintenance instructions.

D. Informational Submittals:
   1. Manufacturer Instructions:
      a. Wood Athletic Flooring:
         1) Published installation instructions. Submit before pre-installation conference.
         2) Manufacture’s installation verification requirements and schedule.

E. Shop Drawings: Indicate floor joint pattern and termination details.
   1. Indicate provisions for expansion and contraction and wall base.
   2. Indicate size and type fasteners and anchors.
   3. Indicate location, size, design, and color of game markings.

F. Samples: Submit two samples 2 1/4" by 6" in size showing floor finish, color, and sheen.

G. Manufacturer's Instructions: Indicate standard and special installation procedures.

H. Maintenance Data: Include maintenance procedures and recommended maintenance materials.

I. Manufacturer's qualification statement.

J. Installer's qualification statement.

K. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Final, executed copy of Warranty.
      b. Record Documentation:
         1) Manufacturers documentation:
            (a) Manufacturer's literature.
         2) Testing Inspection Reports:
            (a) Testing Agency Testing Reports of Alkalinity and Concrete Moisture tests.

## 1.06 QUALITY ASSURANCE

A. Owner will provide Testing for Alkalinity and Concrete Moisture of concrete slab before installation of flooring:
   1. See Section 01 1200: ‘Multiple Contract Summary’.
   2. See Section 09 0503: ‘Flooring Substrate Preparation’ for Field Testing for Alkalinity and Concrete Moisture of concrete slab.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
   1. Minimum five years of documented experience.
   2. Approval subject to agreement process approval.

C. Installer Qualifications: Company specializing in installing products specified in this section.
   1. Minimum three years of documented experience.
   2. Wood Athletic Flooring Installer: Qualified and approved by Manufacturer.
   3. Paint Installer:
      a. As recommended by Floor Finish Manufacturer.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and store off the floor in a well-ventilated, weather-tight space.

B. Deliver products to job site in original unopened containers or wrappings bearing all seals and approvals.

C. Delivery and Acceptance Requirements:
   1. Wood Athletic Flooring
      a. Do not deliver wood materials to Project until interior painting and tile work is completed but before pre-installation conference.
   2. Moisture Suppression Membrane Underlayment:
      a. Deliver products to job site in original unopened containers or wrappings bearing all seals and approvals prior to installation.

D. Storage And Handling Requirements:
   1. Wood Athletic Flooring:
      a. Store wood materials on premises in area with environmental conditions as specified in Field Conditions to allow acclimation to moisture content that will prevail under environmental conditions under which building will be operated.
      b. Pile bundled wood materials loosely to allow uniform acclimation.
   2. Moisture Suppression Membrane Underlayment (Option A):
      a. Follow Manufacturer's instructions and precautions for storage of materials and accessories.
      b. Store Seam Tape indoors in cool, dry area at temperatures between 60 deg F (16 deg C) and 80 deg F (27 deg C).

**1.08 FIELD CONDITIONS**

A. Do not install wood flooring until wet construction work is complete and permanent heat and air conditioning is installed and operating.

B. Maintain room temperature between 55 degrees F and 75 degrees F and relative humidity between 35 to 50 percent for a period of seven days prior to delivery of materials to installation space, during installation, and after installation.

C. Acclimate wood flooring materials to installation space a minimum of 48 hours prior to installation.
   1. Conditions inside building shall be brought to levels to be normal at occupancy of building.
   2. Maintain these conditions from time flooring material is delivered to site to time Certificate of Substantial Completion is signed.
   3. Conditions include normal levels of humidity, lighting, heating, and air conditioning.

D. Concrete Slab:
   1. General:
      a. Final determination as to whether or not a concrete slab is dry enough for flooring installation should be based on evaluating both Alkalinity and Concrete Moisture Vapor Emission Rate (MVER) testing as specified in Section 09 0561 - Common Work Results for Flooring Preparation.
   2. Alkalinity:
      a. Do not install wood flooring if alkalinity of concrete surface exceeds pH level 9.

E. Corrective procedures are required.
   1. Concrete Moisture Vapor Emission Rate (MVER):
      a. Testing conditions inside building shall be brought to same ambient temperature and relative humidity levels to be normal at occupancy of building. Conditions include normal levels of humidity, lighting, heating, and air conditioning.
      b. Follow requirements specified in Section 09 0561 - Common Work Results for Flooring Preparation before installation of wood flooring.

F. Moisture Suppression Membrane Underlayment:
   1. Acclimate membrane for twenty four (24) hours minimum at job site location.

**1.09 WARRANTY**

A. Manufacturer Warranty:
   1. Wood Athletic Flooring:
      a. Flooring Company's two year written guarantee covering labor and materials:
         1) Follow Manufacturer's verification procedures of installation conditions necessary for issuance of warranty.
   2. Moisture Suppression Membrane Underlayment:
      a. Membrane Manufacturer's standard warranty.

**PART 2 PRODUCTS**

**2.01 WOOD ATHLETIC FLOORING**

A. Manufacturer:
   1. Approved Manufacturers. See Section 01 6200 .
      a. Action Cush I by Action Floor Systems, Mercer, WI, 1-800-746-3512 x 458, FAX 715-476-3585, e-mail: matt@actionfloors.com.
      b. Bio-Cushion by Robbins Sports Surfaces, Cincinnati, OH Todd Goodridge (800) 543 1913 ext 5933 FAX 513-871-7998, e-mail toddg@robbinsfloor.com.

B. C. Product:
   1. 1. Approved Products. See Section 01 6200 :
      a. Action Floor Systems, LLC:
         1) Northern Hard Maple in random lengths or continuous strip LL.
      b. Robbins Sports Surfaces:
         1) Northern Hard Maple in random lengths or continuous strip XL.

**2.02 COMPONENTS**

A. Moisture Suppression Membrane Underlayment:
   1. Remediation if directed by Wood Athletic Flooring Manufacturers where high moisture exists based on moisture testing specified in Section 09 0561.
   2. Material:
      a. Description:
         1) Pre-formed moisture suppression membrane installed over concrete subfloor as floor covering underlayment where high moisture exists.
      b. Free-standing composite membrane with following characteristics:
         1) Moisture transmission of less than 0.09 perm as per ASTM E96/E96M.
         2) Mold, Mildew and fungus resistant as per ASTM D3273: No growth.
      c. Accessories:
         1) Moisture suppression underlayment seam tape with pressure sensitive adhesive.
      d. Acceptable Products:
         1) VersaShield by Halex Corporation, Pomona, CA www.halexcorp.com.
         2) Equal as approved by Owner's Representative and Wood Athletic Manufacture before installation.

B. Moisture Suppression:
   1. Remediation to be discussed with Owner’s Representative and Wood Athletic Flooring Manufacturers where high moisture exists based on moisture testing specified in Section 09 0503.

C. Vapor Retarder Membrane:
   1. 6 mil (0.152 mm) polyethylene.
   2. PVC tape or adhesive.

D. Resilient Pads: 2-1/4 inches (57 mm) wide by 3 inches (75 mm) long by 3/8 inch (9 mm) thick PVC pads with slots or air cells.

E. Subfloor Plywood: Four-ply minimum, APA graded and stamped, 15/32 inch (12 mm) CDX plywood.

F. Finish Flooring (select one option):
   1. Meetinghouse with normal humidity;
      a. Hardwood: Northern Hard Maple, No. 3 and better grade MFMA trademarked and grade marked. 25/32 inch by 2-1/4 inch (19.8 mm by 57 mm) minimum, MFMA-RL or MFMA-FJ, with specially milled ends.
   2. Meetinghouse with exceptionally high humidity:
      a. Hardwood: Northern Hard Maple, No. 3 and better grade MFMA trademarked and grade marked. 25/32 inch by 1-1/2 inch (19.8 mm by 38 mm) minimum, MFMA-RL or MFMA-FJ, with specially milled ends.
   3. Stake Center with normal humidity:
      a. Hardwood: Northern Hard Maple, No. 2 and better grade MFMA trademarked and grade marked. 25/32 inch by 2-1/4 inch (19.8 mm by 57 mm) minimum, MFMA-RL or MFMA-FJ, with specially milled ends.
   4. Stake Center with exceptionally high humidity:
      a. Hardwood: Northern Hard Maple, No. 2 and better grade MFMA trademarked and grade marked. 25/32 inch by 1-1/2 inch (19.8 mm by 38 mm) minimum, MFMA-RL or MFMA-FJ, with specially milled ends.
   5. Fasteners: Power-driven, 2 inch (50 mm) long barbed cleats or coated staples recommended by Flooring Manufacturer.

G. Base: 2-1/2 inches by 2-1/2 inches by 1/8 inch (64 mm by 64mm by 3 mm) aluminum angle in clear anodized finish.

H. Threshold Plate: 5 inches (125 mm) wide by 1/4 inch (6 mm) thick aluminum, fluted on top, slightly tapered both edges in finish selected by Architect.

I. Finish:
   1. Sealer: As recommended by Top Coat Manufacturer.
   2. Top Coats:
      a. Description:
         1) High gloss, high solids  water based finishes.
      b. Oil Modified Urethane:
         1) Approved Products. See Section 01 6000:
         2) Note: Oil finish to only be used as a sealer of floor after it is sanded, where allowed by the AHJ. If not allowed, contractor is to use water based finish. Oil finish is not to be used in any screen and recoats.
            (a) Standard finish:
               (1) Hillyard 350 Gym Finish or Gold Medalist Gym Finish by Hillyard Industries, St. Joseph, MO www.hillyard.com.
      c. Water Based (for Sustainable Design Requirements and/or low odor) Finish:
         1) Approved Products. See Section 01 6000:
            (a) Hillyard Courtguard/ 1907 or Pro Sanding Seal/ Pro 100 by Hillyard Industries, St. Joseph, MO www.hillyard.com
            (b) Spartan Aqua Force 5843 by Spartan Chemical Company, Inc. Maumee, OH  www.spartanchemical.com
               (1) Two coats required
            (c) Bona SuperCourt Optum by BonaKemi USA, Inc. Englewood, CO www.diversey.com
               (1) Two coats required
      d. Colors:
         1) Basketball: Black
         2) Volleyball: White
         3) Pickleball: Blue
         4) Auxiliary volleyball: Grey
   3. Sealer or primer to be recommended by finish manufacturer
      Description: 30% solids, water-based seal and primer

## 2.03 ACCESSORIES

A. Transition Strip: Same species and finish as flooring material; profiles indicated.

B. Adhesives: Types recommended by flooring manufacturer.
   1. VOC Content:
      a. Manufacturer's standard for application indicated that has VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

# PART 3 EXECUTION

## 3.01 INSTALLERS

A. Approved Wood Athletic Flooring Installers. See Section 01 6000:
   1. Action Floor Systems:
      a. <Insert Installers>.
      b. <Insert Installers>.
      c. <Insert Installers>.
   2. Robbins
      a. <Insert Installers>.
      b. <Insert Installers>.
      c. <Insert Installers>.

## 3.02 EXAMINATION

A. Verify existing conditions before starting this work.

B. Follow Flooring Manufacturer's prescribed inspection procedure for determining acceptability of installation conditions, including environmental conditions in building during and after installation, moisture content of slab, flatness and levelness of slab, etc.

C. Verify that concrete subfloor surface is smooth and flat to plus or minus 1/4 inch in 10 feet.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561.
   2. Test in accordance with ASTM F710.
   3. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

F. Verify ventilation requirements as specified in Field Conditions in Part 1 of this specification have been maintained before proceeding with applying wood floor finish.

G. Evaluation And Assessment:
   1. Wood Athletic Flooring:
   2. Verify before installing aluminum angle base, location of framing member base plate or vertical framing member if attachment to framing member base plate is not feasible.

## 3.03 PREPARATION

A. Prepare substrate to receive wood flooring in accordance with manufacturer's instructions.

B. Correct deficiencies identified during Pre-Installation Conference and confirm acceptance and approval of substrate with Architect before beginning installation of flooring system.

C. Concrete floor slab patching:
   1. Cracks, chips and joints must be properly patched or repaired.

D. Concrete surface cured, clean, dry, and free of foreign substances that will compromise flooring installation.
   1. Removal of curing compounds.
   2. Remove paint, sealer, grease, oil, silicone sealants, and other materials incompatible with flooring adhesives.
   3. Removal of overspray from painted walls (essential so glue will stick).

E. Moisture vapor emission tests and alkalinity test of concrete slab has been performed.

F. Vacuum and damp mop floor areas to receive flooring before flooring installation.

**3.04 INSTALLATION**

A. Do not install wood flooring until interior 'wet type' systems are dried out and overhead trades have completed work in wood floor areas.

B. Moisture Suppression Membrane Underlayment:
   1. Remediation if directed by Wood Floor Manufacturers where high moisture exists based on moisture testing specified in Section 09 0561.
   2. Installation:
      a. Install membrane with smooth film side facing concrete slab.
      b. Install in accordance with membrane manufacturer's current written installation instructions.
      c. Do not install with mechanically fastened wood floor system.
      d. Do not install below grade where hydrostatic pressure exists.
   3. Apply Manufacturer's approved adhesive as per written installation instructions.
   4. Protect membrane from damage during installation and application of adhesive:
      a. Do not tear, rip, puncture, or delaminate membrane when applying adhesive.
      b. Repair damaged areas according to membrane manufacturer’s instructions before wood flooring installation.
      c. Provide continuous, intact moisture suppression membrane under entire designated flooring area.
   5. Install wood flooring on top of underlayment membrane.

C. Vapor Retarder Membrane:
   1. Lap joints 6 inches (150 mm) and completely seal.
   2. Extend and terminate membrane at walls.

D. Cushioned Panels:
   1. Place 32 resilient pads on under-side of first layer of plywood 6 inches (150 mm) in from edges of plywood and 12 inches (300 mm) on center each way.
   2. Lay plywood parallel to short dimension of room with 1/4 inch (6 mm) spacing at joints.
   3. Place second layer of plywood on diagonal with first layer, with 1/4 inch (6 mm) joints, and secure by screwing, nailing, or stapling, as acceptable to Flooring Manufacturer, at 12 inches (300 mm) on center.
   4. Expansion Provisions:
      a. Leave 1-1/2 inches (38 mm) gap between flooring and walls for expansion at perimeters.

E. Volleyball Floor Plates:
   1. Install in accordance with Plate Manufacturer's instructions and as detailed.

F. Laying And Power Nailing of Finish Flooring:
   1. Lay flooring parallel to long dimension of room.
   2. Tightly drive end joints and properly fit side joints to meet requirements of Manufacturer to meet humidity requirements.
   3. Machine nail.

G. Aluminum Angle Base:
   1. Wood-Framed Walls:
      a. Firmly attach only to wall with panhead, cadmium plated, wood screws.
      b. Length of screws shall be sufficient to embed in substrate 1-1/2 inches (38 mm) minimum.
      c. Attachment to wall:
         1) Framing member base plate attachment:

(a) Locate screws 3 inches (75 mm) maximum from edge and 24 inches (600 mm) maximum on center spacing between screws into framing member base plate.

2) Vertical Framing member attachment:

(a) Match vertical framing member.

2. Placing screws:
   a. Place screws approximately one inch down from top of base.
      1) If screw attachment will miss framing member base plate, locate attachment into vertical framing member.
3. Spacer:
   a. Attach one 3/16 inch by 1/2 inch by one-inch (5 mm by 13 mm by 25 mm) masonite spacer to metal angle base immediately above each screw hole with contact cement.
4. Tighten screws to bring base into gentle contact with floor.
   a. Do not interfere with free movement of floor.
5. Miter corner joints and grind toe of base on outside corners to 1/2 inch (13 mm) radius. Grind or file down burrs and rough or sharp edges at joints.
6. Leave in true alignment with 3/16 inch (5 mm) space between wall and base.

H. Aluminum Threshold:
1. Neatly and substantially anchor aluminum threshold plates located across expansion gaps at door and other floor surface openings with permanent type rust proof anchors. Do not fasten to wood floor.
2. Do not lag fixtures, equipment, plates, outlet boxes, or other items through subfloor to floor unless adequate provision is made for expansion.

I. Sanding Sequence:
1. Make sure floor is free of moisture.
2. Sweep floors clean.
3. Sand with heavy, power driven type sander. Use dust accumulator on machine.
4. Begin sanding with No. 36 or No. 40 grit sandpaper. Sand on diagonal if required to level boards.
5. Proceed with medium grit, 50 or 60 grit sandpaper. Perform this sanding and subsequent sanding passes in direction of grain of floor.
6. Sand edges with No. 60 or 80 grit spinner paper.
7. Sand entire floor with No.80 or 100 grit sandpaper.
8. Disk and entire floor with No. 100 disk paper. Finish with 120 screens.
9. Scrape and hand-sand corners and other areas not reached by machine.

J. Finishing:
1. Allow for adequate ventilation to insure proper curing.
2. Apply two (2) coats of sealer at rate and instructions recommended by Finish Manufacturer. Applicator ensures no finish is applied to all rubber/aluminum bases, thresholds, volleyball pole inserts, and pickleball pole spaces.

K. Vacuum, screen and tack between coats as recommended by Finish Manufacturer. (Note: solvent based sealer is preferred where feasible).
1. Proper screening, vacuuming and tacking procedures should be followed at each stage of finishing process.
2. Apply game lines.
3. Apply top coats with ample time between coats for material to properly dry before applying additional coats:
   a. Coverage per gallon (liter) shall be at rate and number of coats recommended by Finish Manufacturer (Typically two (2) coats unless using high solids high performance products).
   b. Top coats can consist of additional sealer or lower solids product followed with final high solids or high performance top coat.

## 3.05 FIELD QUALITY CONTROL

A. Field Tests:
   1. See Section 09 0561 - Common Work Results for Flooring Preparation for Field Testing for Alkalinity and Concrete Moisture of concrete slab.

## 3.06 CLEANING

A. Waste Management:
   1. Installer’s Responsibility:
      a. All work areas are to be kept clean, clear and free of debris at all times.
      b. Disposal of rubbish in provided dumpster(s).
   2. Contractor’s Responsibility:
      a. Provide adequate waste receptacles (dumpsters) and dispose of Owner Furnished materials from building and property as specified in Section 01 7400.

## 3.07 PROTECTION

A. Contractor's responsibility:
   1. Prohibit traffic on finished floor for 72 hours after installation.
   2. Protect flooring from abuse, vandalism, contaminants, or damage occurring after installation is complete.
   3. Protect floor finish until Substantial Completion.

**END OF SECTION 09 6466**

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**SECTION 09 6500**
**RESILIENT FLOORING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Resilient base.

B. Resilient stair accessories.

### 1.02 REFERENCE STANDARDS

A. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials 2006.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

C. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

D. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate completion of flooring installation with other trades.
   2. Sequencing:
      a. Installation of Resilient Tile and Resilient Base.

B. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 09 0561 and held jointly with Section 09 6813 and Section 09 6816 pre-installation conference.
   2. In addition to agenda items specified in Section 01 3100, review following:
   3. Review Building Ambient Conditions including normal levels of humidity, lighting, heating, and air conditioning for acceptability for beginning floor preparation and flooring installation.
   4. In addition to agenda items specified in Section 01 3000 and Section 09 0561, review following:
      a. Review if stairs are included for Project.
      b. Review if stair skirts are included for Project.

### 1.04 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions and maintenance instructions.

B. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturers documentation:
            (a) Manufacturer’s literature.
            (b) Color and style selection.
         2) Testing and Inspection Reports:
            (a) Testing Agency Testing Reports of Alkalinity and Concrete Moisture testing.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Wall Base: 20 linear feet of each type and color.

## 1.05 QUALITY ASSURANCE

A. Definitions:
   1. Flame Spread: Propagation of flame over a surface.
   2. Flame Spread Index: The numerical value assigned to a material tested in accordance with ASTM E84 or UL 723.
   3. Resilient Wall Base Classification:
      a. Type:
         1) TS: Rubber, vulcanized thermoset.
         2) TP: Rubber, thermoplastic.
         3) TV: Vinyl, thermoplastic.
      b. Group:
         1) Group 1: Solid (homogeneous).
         2) Group 2: Layered (multiple layers).
      c. Styles:
         1) Style A: Straight.
         2) Style B: Cove.
         3) Style C: Butt-to.
   4. Resilient Stair Tread Classification:
      a. Type:
         1) TS: Rubber, vulcanized thermoset.
         2) TP: Rubber, thermoplastic.
         3) TV: Vinyl, thermoplastic.
      b. Class:
         1) Class 1: Smooth (flat).
         2) Class 2: Pattern: embossed, grooved or ribbed.
      c. Group:
         1) Group 1: Abrasive strips embedded.
         2) Group 2: Contrasting color for visually impaired.
   5. Smoke-Developed Index: The numerical value assigned to a material tested in accordance with ASTM E84 or UL 723.
   6. Regulatory Agency Sustainability Approvals:
      a. Fire-Test-Response Characteristics:
         1) Surface-Burning Characteristics:
            (a) Base shall have Class B flame spread rating in accordance with ASTM E84 or UL 723.

## 1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in undamaged and unopened packaging or containers with Manufacturer’s labels intact.

B. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

C. Store all materials off of the floor in an acclimatized, weather-tight space.

D. Adhesive:
   1. Product Acclimation:
      a. Materials should be present at jobsite for at least forty-eight (48) hours with ambient temperature between 65 deg F (18.3 deg C) to 85 deg F (29.4 deg C) for at least seventy-two (72) hour prior to installation or recommendations requirements of Manufacturer.

E. Maintain temperature in storage area between 55 degrees F and 85 degrees F.

F. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

G. Protect roll materials from damage by storing on end.

**1.07 FIELD CONDITIONS**

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

B. Ambient Conditions:
   1. Building Conditions:
      a. Conditions inside building shall be brought to levels to be normal at occupancy of building.
      b. Conditions include normal levels of humidity, lighting, heating, and air conditioning.

**PART 2 PRODUCTS**

**2.01 STAIR COVERING**

A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness.
   1. Manufacturers:
      a. Burke Flooring; Diamond Pattern Rubber Stair Treads: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company; Heavy Duty Diamond Rubber Stair Tread: www.johnsonite.com/#sle.
      c. Roppe Corp; Stair Treads (Diamon Design): www.roppe.com/#sle.
      d. Heavy Duty Rubber Stair Treads by Flexco.
      e. Stair Tread by VPI.
   2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
   3. Minimum Requirements: Comply with ASTM F2169, Type TP, rubber, thermoset.
   4. Nominal Thickness: 0.1875 inch.
   5. Nosing: Square.
   6. Texture: Nonslip; no abrasive strips.
   7. Color:
      a. To be selected by Architect from manufacturer's standard range.
      b. Color pigments used shall be highly fade-resistant, insoluble in water, and resistant to light, alkali, and cleaning agents.

B. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.
   1. Manufacturers:
      a. Provide same manufacture and color as stair treads.
   2. Thickness: 0.125 inch.
   3. Risers integral with treads are acceptable.

C. Stair Skirts:
   1. General:
      a. Cut from stock 0.125 inch by maximum length available to contour and profile of stairs.
      b. Color: Same color as treads.
   2. Design Criteria:
      a. Meet requirements of ASTM F2169, Type TP or TS, Class 2.
   3. Manufacturers:
      a. Provide from Same Manufacturer as Stair Treads.

D. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color.
   1. Nominal Thickness: 0.080 inch.

**2.02 RESILIENT BASE**

A. Resilient Base - Type [____]: ASTM F1861, Type TS rubber, vulcanized thermoset or Type TP, rubber, thermoplastic; top set Style B, Cove.
   1. Manufacturers:
      a. Burke Flooring; RubberMyte Wall Base: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company; Rubber Wall Base: www.johnsonite.com/#sle.
      c. Roppe Corp; Rubber Wall Base: www.roppe.com/#sle.
      d. Base 2000 Wall Base by Flexco.
      e. Rubber Wall Base by VPI.
   2. Base shall have Class B flame spread rating in accordance with ASTM E84 or UL 723.
   3. Free from objectionable odors, blisters, cracks, and other defects affecting appearance or serviceability of rubber, and not containing fabric.
   4. Approved Colors:
      a. Color pigments used shall be highly fade-resistant, insoluble in water, and resistant to light, alkali, and cleaning agents.
      b. Colors as selected by Architect from Manufacturer's standard colors.
   5. Height: 4 inch.
   6. Thickness: 0.125 inch.
   7. Finish: Satin.
   8. Length: Roll.
   9. Accessories: Premolded external corners and internal corners,butt joint interior corners, corners must meet same height and thickness requirements as wall base.

**2.03 ACCESSORIES**

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by manufacturer.

B. Moldings, Transition and Edge Strips: Same material as flooring.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. 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.

B. Notify Architect of unsuitable conditions in writing:

C. Do not start work until defects are corrected.

D. Commencement of Work by installer is considered acceptance of substrate.

**3.02 PREPARATION**

A. Clean substrate.

**3.03 INSTALLATION - GENERAL**

A. Starting installation constitutes acceptance of 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.

**3.04 INSTALLATION - RESILIENT BASE**

A. Install in manner to produce smooth, even finished surfaces tightly jointed and accurately aligned.

B. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

C. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

D. Install base on solid backing. Bond tightly to wall and floor surfaces.

E. Scribe and fit to door frames and other interruptions.

F. Fit specified items tightly. Use fillers where necessary. Fit neatly against projections, piping, electrical service outlets, etc.

G. Secure specified items with specified adhesive. Cement substantially to vertical surfaces including rubber base to cabinet work base.

H. Line up top and bottom lines of base throughout.

I. Do not stretch base during installation.

J. Roll until firm bond has been established. Leave level, free from buckles, cracks, and projecting edges.

K. In wall runs longer than 12 inches (300 mm), install no lengths of base shorter than 12 inches (300 mm) long.

**3.05 INSTALLATION - STAIR COVERINGS**

A. Install stair coverings in one piece for full width and depth of tread.

B. Install stringers configured tightly to stair profile.

C. Set full treads on intermediate and floor landings. No joints will be accepted in treads.

D. Adhere over entire surface with no bare spots. Fit accurately and securely.

E. Roll and pound treads to assure adhesion.

**3.06 FIELD QUALITY CONTROL**

A. Field Tests:
   1. Resilient base:
      a. See Section 09 0561 ‘Common Work Results for Flooring Preparation’.
   2. Non-Conforming Work:
      a. Replace damaged materials at no additional cost to Owner.
      b. Damaged materials are defined as having cuts, gouges, scrapes or tears, and not fully adhered.

**3.07 CLEANING**

A. General:
   1. Adjacent Work:
      a. Clean all exposed surfaces of adjoining areas of adhesive spatter before it sets.

B. Resilient Base And Accessories:
   1. Clean all exposed surfaces of base of adhesive spatter before it sets in accordance with Manufacturer’s cleaning instructions.
   2. Damp-mop surfaces to remove marks and soil.

**3.08 PROTECTION**

A. Resilient Base And Accessories:
   1. Cover material until Substantial Completion.
   2. Keep traffic away until adhesive has set.

**END OF SECTION**

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**SECTION 09 6816**
**SHEET CARPETING - BACK CUSHION, DIRECT GLUE**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Section Includes But Is Not Limited To:
   1. Coordination, sequencing, and scheduling installation of Owner-Furnished carpet, carpet tile, carpet base, carpet accessories, leveling compounds as described in Contract Documents and including following:
      a. Maintain Building Ambient Conditions including normal levels of humidity, lighting, heating, and air conditioning for acceptability for beginning floor preparation and carpet installation.
      b. Protection of carpet after installation of carpeting as required.

B. Related Requirements:
   1. Section 01 1000 - Summary: for carpet and carpet base excluded from Contract and furnished and installed by Owner. This Section establishes quality of materials and installation for information of Contractor, Architect, and Owner's Representatives.
   2. Section 03 3000 - Cast-in-Place Concrete: for provision of acceptable concrete substrate.
   3. Section 09 0561 - Common Work Results for Flooring Preparation for:
      a. Floor substrate preparation.
      b. Pre-installation conference for Sections under 09 6000 heading ‘Flooring.
   4. Section 09 6500 - Resilient Flooring: for resilient base.

### 1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate completion of carpet installation with other trades.

B. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 09 0561.
   2. Schedule pre-installation conference before installation of flooring system.
   3. Conference may be held at project site or another convenient site. Participants may also attend by video or audio conference if approved by Project Manager.
   4. Schedule conference after substrate preparation and ONE (1) week before installation of flooring system.
   5. In addition to agenda items specified Section 01 3000 and Section 09 0561, review following:
      a. Review Owner’s Representative schedule for furnishing and installation carpet.
      b. Review Flooring Manufacturer's installation conditions verification procedure and requirements.
      c. Review Building Ambient Conditions including normal levels of humidity, lighting, heating, and air conditioning for acceptability for beginning floor preparation and carpet installation.
      d. Review cleaning and disposal requirements.
      e. Review protection requirements of carpet after installation of carpeting.

C. Scheduling:
   1. Notify Flooring Installer when Building Ambient Conditions requirements are met before installation of flooring system.
   2. Notify Owner’s Representative to coordinate installation of carpet.

## 1.03 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Copy of Warranty.
      b. Record Documentation:
         1) Owner will provide Project Carpet Request Documentation forms in both hard copy and digital format:
            (a) Carpet Request Information Sheet.
            (b) Carpet Vendor Quotation.
            (c) Carpet Preinstallation Meeting Agenda.
            (d) Carpet Installation Notice to Proceed or Cancel.
            (e) Carpet Inspection and Completion.
            (f) Carpet Overage Report and Completion.
            (g) Carpet Quotation Change Request.

B. Maintenance Material Submittals:
   1. Extra Stock Materials:
      a. Leave piece of carpet consisting of 12 sq yds (10 sq m), and 25 lineal feet (7.62 meters) minimum of carpet cove base.
      b. Roll up and tie securely

## 1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. All products provided will meet requirements of all federal, state, and local codes having jurisdiction.
   2. Label meeting Federal Labeling Requirements, as stated in Textile Products Identification Act under Federal Trade Commission, shall be attached to certification samples and products delivered.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. General:
   1. Comply with instructions and recommendations of Manufacturer for special delivery, storage, and handling requirements.

B. Delivery And Acceptance Requirements:
   1. Deliver materials and accessories necessary for completion of carpet installation to site before beginning installation of carpet.
   2. Do not deliver materials before date scheduled for installation.
   3. Transport carpet in manner that prevents damage and distortion. Bending or folding individual carpet rolls or cuts from rolls is not recommended. When bending or folding is unavoidable for delivery purposes, carpet is required to be unrolled and allowed to lie flat immediately upon arrival at installation site.

C. Storage And Handling Requirements:
   1. Store carpet and related materials in a climate-controlled, dry space.
   2. Protect carpet from soil, dust, moisture and other contaminants and store on a flat surface.
   3. Stacking heavy objects on top of carpet rolls or stacking more than three rolls is prohibited.

## 1.06 FIELD CONDITIONS

A. Ambient Conditions:
   1. Building Conditions:
      a. Conditions inside building shall be brought to levels to be normal at occupancy of building. Conditions include normal levels of humidity, lighting, heating, and air conditioning. (HVAC must be in operation thru out carpet installation):
         1) Carpet installation is not to begin until HVAC system is operational and following conditions are maintained for at least forty-eight (48) hours before, during and seventy-two (72) hours after completion:
            (a) Carpet is to be installed when indoor temperature is between 65º - 95º F (18º - 35º C) with maximum relative humidity of 65%.
            (b) Substrate surface temperature should not be less than 65º F (18º C) at time of installation.
            (c) Do not allow temperature of indoor carpeted areas to fall below 50º F (10º C), regardless of age of installation.
         2) Maintain fresh air ventilation after installation for seventy-two (72) hours minimum or until lingering odors are gone.
   2. Concrete Slab:
      a. General:
         1) Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive.

## 1.07 WARRANTY

A. Manufacturer Warranty:
   1. Provide Carpet Manufacturer's standard Warranty which includes following:
      a. Warranty shall cover defects in installation, workmanship, and installation materials.
      b. Warranty includes specific workmanship warranties for delamination, edge raveling, fuzzing, pilling, and other textural changes which can be controlled through proper manufacturing (no fraying, zippering, delamination, edge raveling, fuzzing, pilling in carpet is acceptable for any reason).
      c. Warranty terms will include inspection of defective area within fifteen (15) days of receipt of written notice from Owner and completion of corrective work within forty-five (45) days, unless other arrangements are made in writing with Owner on case-by-case basis.
      d. Carpet defect or installation defect:
         1) Carpet Manufacturer may use any reasonable means to cure first three (3) breaches of warranty affecting an area of carpeting bounded by natural breaks such as doorways, ('affected carpet area'). Such cure must preserve as uniform a blended appearance, acceptable to Carpet Manufacturer and Owner, as exists throughout Installation Site at time of breach.
         2) If carpet defect or installation defect continues to appear after three (3) separate notices for correction from Owner, replace carpet where defects have occurred.
      e. If Carpet Manufacturer follows installation requirements of Section 09 0561 - Common Work Results for Flooring Preparation, Carpet Manufacturer accepts liability of carpet installation for said given time as outlined in Special Warranty regardless of any climate or condition changes affecting RH levels of floor substrate.
   2. Special Warranty:
      a. Sheet Carpeting:
         1) General:

(a) Appearance Retention to be provided with Special Warranty requirements if not already included in Standard Warranty.

## PART 2 PRODUCTS

### 2.01 OWNER-FURNISHED PRODUCTS

A. Approved Manufacturers. See Section 01 6000:
   1. Materials supplied for carpet installation shall be complete package from specified Carpet Manufacturer:
      a. Mannington Commercial Carpets, Calhoun, GA:
         1) Contact Information: Help Line Voice Mail (800) 241-2262, ext 8045 or Mannington Installation Services, email lds@mannington.com or (855) 466-2664.
      b. Mohawk Group, Calhoun, GA:
         1) Contact Information: Help Line (800) 523-5555 or (801) 397-5626.
      c. Tarkett: Dalton, GA www.commercial.tarkett.com.
         1) Contact Information: Tracy Riddle - cell (801) 580-5147 fax (866) 861-7522 Tracy.Riddle@Tarkett.com.

### 2.02 ACCESSORIES

A. Carpet Accessories: Snap-in vinyl reducer strips and vinyl track.

B. Floor Leveling Compound, Floor Patching Compound, And Latex Underlayment: As recommended and approved by Carpet Manufacturer.

## PART 3 EXECUTION

### 3.01 APPROVED INSTALLER

A. Approved Installers. See Section 01 6000:
   1. Mannington Product: Mannington Installation Services, St. Augustine, FL.
      a. Contact Jaimie Flores, (904) 445-8140, email lds@mannington.com.
   2. Mohawk Product: Certified Sales, Bountiful, UT.
      a. Contact Todd Davis, Office: (801) 397-5626, Toll Free Office(800) 523-5555, Mobile: (801) 592-6758, email todd@certsalesserv.com.
   3. Tarkett Product: Flooring Services Inc., Sandy, UT www.flooringservices.com.
      a. Contact Jason Rowley, office (801) 487-3600 x108, cell (801) 631-8382, email jason@flooringservices.com.

### 3.02 EXAMINATION

A. Verification of Conditions:
   1. Verify required ambient conditions inside building for required normal levels of humidity, lighting, heating, and air conditioning have been maintained for at least forty-eight (48) hours before and during carpet installation and seventy-two (72) after installation of carpet.

B. Evaluation And Assessment:
   1. Carpet Areas:
      a. Variation In Grade:
         1) Plus or minus 1/8 inch (3 mm) in any 10 foot (3 meter) of floor slab and distance between high point and low point of slab of 1/2 inch (13 mm).
      b. Testing Procedure:
         1) Place ends of straightedge on 3/8 inch (10 mm) high shims.

2) Floor is satisfactory if 1/4 inch (6 mm) diameter steel rod rolled under straightedge will not touch anywhere along 10 foot (3 meter) length and 1/2 inch (13 mm) diameter steel rod will not fit under straightedge anywhere along 10 foot (3 meter) length.

c. Notify Owner's Representative in writing if floor surface is not acceptable to install carpet:

1) Do not lay carpet over unsuitable surface. Commencing installation constitutes acceptance of floor and approval of existing conditions.

**3.03 PREPARATION**

A. Carpet Areas:

1. Flooring Preparation:

a. Owner-Furnished Product Supplier's Responsibility:

1) Prepare floor substrate in accordance with 'CRI Carpet Installation Standard' best practices to receive carpet installation and to provide installation that meets warranty requirements.

2) Verify concrete surface cured, clean, dry, and free of foreign substances that will compromise carpet and/or installation.

3) Verify concrete slab Alkalinity and Concrete Moisture Vapor Emission Rate (MVER) Testing for each Project is within Carpet Manufacturer's acceptable levels to meet warranty requirements.

b. Concrete floor slab patching:

1) Cracks, chips and joints must be properly patched or repaired.

c. Concrete surface cured, clean, dry, and free of foreign substances that will compromise carpet and/or other flooring installations:

1) Removal of curing compounds.

2) Remove paint, sealer, grease, oil, silicone sealants, and other materials incompatible with flooring adhesives.

3) Removal of overspray from painted walls (essential so glue will stick).

d. Vacuum and damp mop floor areas to receive flooring before flooring installation.

2. Relaxing / Conditioning Carpet:

a. Highly recommended that carpet be unrolled and allowed to relax in installation area for time period that conforms to requirements of manufacturer of product being installed:

b. Protect carpet adequately from soil, dust, moisture and other contaminants.

c. Sundry items, such as adhesives, should also be conditioned.

3. Carpet Accessories:

a. Owner-Furnished Product's Responsibility:

1) Sundry items, such as adhesives, shall be conditioned to building ambient conditions before use.

**3.04 ADJUSTING**

A. Inspect and make necessary adjustments within one (1) month after mechanical heat or other heat has been supplied continuously in finished areas.

**3.05 CLEANING**

A. General:

1. Carpeting:

a. Carpet Installer's Responsibility:

1) Remove any soiling and/or staining from carpet.
2) Remove excessive adhesive with manufacturer recommended adhesive removers.

B. Damage to building:
1. Carpeting:
a. Carpet Installer's Responsibility:
1) Carpet Installer responsible for cleaning and repair of all damaged surfaces to their original condition from carpet installation.

C. Waste Management:
1. Contractor’s Responsibility:
a. Provide adequate waste receptacles (dumpsters) and dispose of Owner Furnished materials from building and property as specified in Section 01 7419.
2. Carpet Installer's Responsibility:
a. All work areas are to be kept clean, clear and free of debris at all times.
b. Disposal of rubbish, wrapping paper, scraps, and trimmings in provided dumpster(s).

**3.06 PROTECTION**

A. Protection of Carpeting:
1. Contractor’s Responsibility:
a. No traffic of any kind on newly installed carpet for minimum of twenty-four (24) hours after installation is completed.
b. No wheeled traffic of any kind placement of furniture or equipment on carpet for minimum of forty-eight (48) hours after completion of carpet installation.
c. Protect carpet adequately from soil, dust, moisture and other contaminants after carpet installation.
d. Protect carpet from abuse, vandalism, or damage occurring after installation is complete.

**END OF SECTION**

**SECTION 09 7200**
**WALL COVERINGS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Surface preparation and prime painting.

B. Wall covering and borders.

### 1.02 REFERENCE STANDARDS

A. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).

B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).

C. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor 2013a.

D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2022.

E. ASTM D570 - Standard Test Method for Water Absorption of Plastics 2022.

F. ASTM D638 - Standard Test Method for Tensile Properties of Plastics 2022.

G. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials 2017.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A. Product Data: Provide data on wall covering and adhesive.

B. Samples: Submit two samples of wall covering, ____by____ inch in size illustrating color, finish, and texture.
   1. Exposed molding and trim showing each type, finish, and color.

C. Manufacturer's Installation Instructions: Indicate special procedures.

D. Installer's Qualification Statement.

E. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Cleaning and maintenance instructions.
      b. Record Documentation:
         1) Manufacturers documentation:
            (a) Manufacturer's literature or cut sheet.
            (b) Color and pattern selection.

### 1.04 QUALITY ASSURANCE

A. Installer Qualifications: Minimum one (1) satisfactorily completed installation of comparable quality, scope, similar size, and complexity in past two (2) years before bidding.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

### 1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

## PART 2 PRODUCTS

### 2.01 WALL COVERINGS

A. General Requirements:
   1. Meet or exceed Fed Spec CCC-W-408A Type II, Class A. Requirements of this standard restrict approvals to flame spread no higher than 25.

B. Sisal Wall Covering:
   1. Manufacturers:
      a. Design Materials Inc, Kansas City, KS www.dmikc.com.
      b. Fibreworks, Louisville, KY www.fibreworks.com.
   2. Material:
      a. Sisal Wall Covering. 100 percent fire-treated sisal yarn.
      b. 1/4 inch (6 mm) pile height, 48 oz/sq yd (1 627 grams/sq meter) minimum. Sisal to be installed full height on walls shall be furnished in 9 or 13 foot (2.75 or 3.96 meters) wide goods.
      c. Reversible weave type, without backing.
   3. Colors:
      a. Approved Colors. See Section 01 6000:
         1) Cherry / Blue:
            (a) Design Materials: 108.
            (b) Fibreworks: 712 Ivory.
         2) Cherry / Green:
            (a) Design Materials: 108.
            (b) Fibreworks: 712 Ivory.
         3) Cherry / Red:
            (a) Design Materials: 108.
            (b) Fibreworks: 712 Ivory.
         4) OAK 95 / Blue:
            (a) Design Materials: 108.
            (b) Fibreworks: 712 Ivory.
         5) OAK 95 / Green:
            (a) Design Materials: 108.
            (b) Fibreworks: 712 Ivory.
         6) OAK 95 / Red:
            (a) Design Materials: 108.
            (b) Fibreworks: 712 Ivory.

C. Acoustically Transparent Wall Covering:
   1. Manufacturers:
      a. Acoustone Grille Cloth by Acoustone Corp, Brooklyn, NY www.acoustonegrillecloth.com.
      b. Mellotone by Wendell Fabrics Corp., Blacksburg, SC www.wendellfabrics.com.
   2. Design Criteria:
      a. Transparency to Sound.
         1) Fully accredited testing lab for sound transmissibility.
      b. Sound Absorption.
      c. Fire-Test-Response Characteristics: Class A flame spread rating in accordance with ASTM E84 or UL 723 Type 1.
      d. Withstands Mildew and Dust.

e. Non Sag.

3. Approved Products. See Section 01 6000:
   a. Acoustone Grille Cloth:
      1) FR94*, FR248, FR250, FR260, FR270*, FR 280, FR345*, FR360*, FR401, FR407, FR602*, FR605, FR900*, FR901, FR902*, FR903*, FR 905, FR1000, FR1003, FR1004, FR1005, FR1010, FR 3402, FR3403, FR7000, FR7001*, FR7002, FR7003*, FR7004*, FR7006*, FR7007, FR7008, FR7010*, FR7012, FR7013*, or FR7015* (patterns noted with asterisk are not listed on manufacturer webpage, but all fabrics samples are available from manufacturer).
   b. Mellotone:
      1) DA 5004, DA 5005, DA 5006, DF 6002, DF 6003, or DF 6004 (pattern samples available from manufacturer).
   c. Locations:
      1) Grille Material used at Organ Chamber.

## 2.02 ACCESSORIES

A. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate . Use only fungus resistant adhesives.
   1. Sisal Wall Covering
      a. Approved Products.
         1) 257 Sisal Adhesive by Fibreworks.
         2) Sisal Adhesive No. 1-422 by Design Materials.
   2. Seam Cement:
      a. 8415 Glue-Down Carpet Seam Adhesive by Roberts Consolidated Industries, Div QEP, Henderson, NV www.robertsconsolidated.com.
      b. Equal as recommended by Wall Covering Manufacturer with approval of Architect before installation. See Section 01 6000.

B. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

C. Substrate Primer and Sealer: Alkyd enamel type.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

## 3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

C. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

D. Marks: Seal with shellac those that may bleed through surface finishes.

E. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

F. Vacuum clean surfaces free of loose particles.

## 3.03 INSTALLATION - GENERAL

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

### 3.04 INSTALLATION SISAL WALL COVERING

A. Apply wall covering in accordance with Manufacturer's instructions, available on DVD from Owner through Architect. See Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

B. Using specified adhesive, glue continuously to surface to be covered with wall covering. Apply adhesive in accordance with Manufacturer's recommendations.

C. Run 'ribs' in weaving horizontally (panel style) when installing wall covering full height. If sisal installed only as wainscoting, 'ribs' may be installed vertically. Install wall covering so it extends to within 1/8 inch (3 mm) of floor slab.

D. Carry sisal around corners approximately 6 inch (152 mm) making no outside corner cuts.

E. Apply wall covering in one piece on walls adjacent to stairs leading to Platform to avoid unsightly and challenging seams.

### 3.05 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

C. Fiberglass Reinforced Wall Covering:
   1. Remove excess sealant from panels and moldings.
   2. Refer to manufacturer's specific cleaning recommendations:
      a. Wipe panel down using damp cloth and mild soap solution or cleaner.
      b. Do not use abrasive cleaners.

### 3.06 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

### 3.07 CLOSE-OUT ACTIVITIES

A. Instruction of Owner:
   1. Instruct Owner in proper maintenance and cleaning methods for acoustic wall carpet.

**END OF SECTION 09 7200**

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**SECTION 09 8430**
**SOUND-ABSORBING WALL AND CEILING UNITS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Sound-absorbing panels.

B. Mounting accessories.

### 1.02 REFERENCE STANDARDS

A. 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; 2022.

### 1.03 SUBMITTALS

A. Product Data: Manufacturer's printed data sheets for products specified.

B. Shop Drawings: Fabrication and installation details, panel layout, fabric orientation, and wood grain orientation.

C. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

D. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Cleaning and maintenance instructions.
      b. Warranty Documentation:
         1) Final, executed copy of Warranty.
      c. Record Documentation:
         1) Manufacturers Documentation:
            (a) Manufacturer's literature.
            (b) Color selection.

## PART 2 PRODUCTS

### 2.01 HIGH IMPACT RATED SISAL WRAPPED SOUND ABSORBING UNITS

A. Manufacturer Contact List:
   1. Boomer IV Model 14AF3FW by A & D Specialties Inc., Leadore, ID www.a-d-acousticalpanels.com.
   2. Model CWP by Building Products distributed by Creative West, Salt Lake City, UT www.creativewest.com.

B. Design Criteria:
   1. Meet Class A flame spread rating.
   2. Meet Sound Absorption and Sound Absorption Coefficient requirements as specified in Source Quality Control in this specification.

C. Sound Panels:
   1. Factory-built panels covered with woven sisal provided by same Manufacturer selected and specified in Section 09 7226, without backing.
   2. Nominal 3 inch (75 mm) depth with 2 inches (50 mm) of 1-1/2 lb (0.68 kg) density fiberglass insulation behind one inch (25 mm) of Tectum or Whisper Foam Sound Management Foam by Dow.

D. Approved Colors. See Section 01 6000:
   1. Cherry / Blue:
      a. Design Materials: 108.
      b. Fibreworks: 712 Ivory
   2. Cherry / Green:
      a. Design Materials: 108.

b. Fibreworks: 712 Ivory.
3. Cherry / Red:
a. Design Materials: 108.
b. Fibreworks: 712 Ivory.
4. OAK 95 / Blue:
a. Design Materials: 108.
b. Fibreworks: 712 Ivory.
5. OAK 95 / Green:
a. Design Materials: 108.
b. Fibreworks: 712 Ivory.
6. OAK 95 / Red:
a. Design Materials: 108.
b. Fibreworks: 712 Ivory.
c. Mounting Hardware:
d. Supply proper mounting hardware for substrate on which sound panels are to be mounted.

**2.02 FIBERBOARD SOUND ABSORBING UNITS**

A. Manufacturer Contact List:
1. Homasote Co, West Trenton, NJ www.homasote.com.
2. Knight-Celotex, Northfield, IL www.aknightcompany.com.

B. Sound Deadening Board:
1. 1/2 inch (12.7 mm) thick with NRC of 0.20 minimum.
2. Approved Products. See Section 01 6000.
a. 440 Sound barrier by Homasote.
b. SoundStop by Knight-Celotex.

C. Fasteners:
1. Bugle head screws meeting requirements of ASTM C1002, Type S of length to penetrate steel framing 3/8 inch (9.5 mm) minimum.
2. Bugle head screws meeting requirements of ASTM C1002.
a. Wood Framing: Type W of length to penetrate wood framing 5/8 inch (16 mm) minimum.
b. Steel Framing: Type S of length to penetrate steel framing 3/8 inch (9.5 mm) minimum.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 PREPARATION**

A. Separate boards and allow them to be exposed to Project environmental conditions for 24 hours minimum.

**3.03 INSTALLATION**

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install mounting accessories and supports in accordance with shop drawings.

C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

D. High impact rated sound absorbing units:
1. Factory Installation:
a. Sisal:

1) Using specified adhesive, glue continuously to surface to be covered with wall covering. Apply adhesive in accordance with Adhesive Manufacturer's recommendations.
2) Run 'ribs' in weaving horizontally (panel style) to match direction of sisal installed full height on wall directly behind panels as specified in Section 09 7226 ‘Sisal Wall Covering’.

2. Field Installation:
   a. Follow Manufacturer’s written installation instructions for layout, plumb, and attachment to substrate with supplied fasteners.

E. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
1. Plumb and level.
2. Flatness.
3. Width of joints.

**END OF SECTION 09 8430**

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**SECTION 09 9113**
**EXTERIOR PAINTING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

### 1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

### 1.03 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

D. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Schedule painting pre-installation conference after delivery of paint or coatings and before or at same time as application of field samples.
      a. Coordinate pre-installation conferences of all related painting and coating Sections under 09 9000 heading ‘Paints and Coatings’.
      b. Schedule conference before preparation of control samples as specified in Sections under 09 9000 heading ‘Paints and Coatings’.
      c. Conference to be held at same time as Section 09 2116 to review gypsum board finish preparation.
   2. In addition to agenda items specified in Section 01 3000, review following:
      a. Review Quality Assurance for Approval requirements.
      b. Review Quality Assurance Field Sample requirements.
      c. Review Submittal requirements for compliance for MPI Approved Products.
      d. Review Design Criteria requirements.
      e. Review Cleaning requirements.
      f. Review painting schedule.
      g. Review safety issues.
   3. Review additional agenda items from Sections under 09 9000 heading ‘Paints and Coatings’.

### 1.05 SUBMITTALS

A. 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. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. Confirmation of colors selected and that each area to be painted or coated has color selected for it.

B. Samples: Submit two paper "draw down" samples, 4 x 6 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, submit each color in each sheen available.

C. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturer’s documentation:
            (a) Manufacturer's cut sheet for each component of each system.
            (b) Schedule showing rooms and surfaces where each system was used.

## 1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and minimum five (5) satisfactorily completed projects of comparable quality, similar size, and complexity in past three (3) years before bidding.
   1. Maintain qualified crew of painters throughout duration of the Work.
   2. Upon request, submit documentation.

## 1.07 MOCK-UPS

A. Before application of any paint system, meet on Project site with Architect, Owner's representative, and Manufacturer's representative. Architect may select one (1) surface for application of each paint system specified. This process will include establishing acceptable substrate conditions required for Project before application of paints and coatings.

B. Apply paint systems to surfaces indicated by Architect following procedures outlined in Contract Documents and Product Data submission specified above.

C. After approval of samples, proceed with application of paint system throughout Project. Approved samples will serve as standard of acceptability.

## 1.08 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 55 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Deliver amount of materials necessary to meet Project requirements in single shipment.

E. Notify Architect two working days before delivery of coatings.

F. Store materials in single place.

G. Keep storage area clean and rectify any damage to area at completion of work of this Section.

H. Maintain storage area at 55 deg F (13 deg C) minimum.

## 1.09 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.

E. Provide lighting level of 540 Lux 50 ft candles measured mid-height at substrate surface.

1. Inspection of painting work shall take place under same lighting conditions as application.
2. If painting and coating work is applied under temporary lighting, deficiencies discovered upon installation of permanent lighting will be considered latent damage as defined in MPI Manual, PDCA P1-92.

## PART 2 PRODUCTS

### 2.01 PERFORMANCE AND DESIGN CRITERIA

A. Regulatory Agency Sustainability Approval:
   1. Conform to work place safety regulations and requirements of those authorities having jurisdiction for storage, mixing, application and disposal of all paint and related hazardous materials.
   2. Paint and painting materials shall be free of lead and mercury, and have VOC levels acceptable to local jurisdiction.
   3. Master Painters Institute (MPI) Standards:
      a. Products: Comply with MPI standards indicated and listed in 'MPI Approved Products List'.
      b. Preparation and Workmanship: Comply with requirements in 'MPI Architectural Painting Specification Manual' for products and coatings indicated.

B. Performance:
   1. Design Criteria:
      a. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
      b. All materials, preparation and workmanship shall conform to requirements of 'Architectural Painting Specification Manual' by Master Painters Institute (MPI).
      c. All paint manufacturers and products used shall be as listed under Approved Product List section of MPI Painting Manual.
      d. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.
      e. Where specified paint system does not have Premium Grade, provide Budget Grade.
      f. Provide products of same manufacturer for each coat in coating system.
      g. Color Levels:
         1) Color Level II:
            (a) Number and placement of interior and exterior paint colors and gloss levels shall be as defined by Color Level II from MPI Manual, PDCA P3-93 as modified in following paragraph.
            (b) No more than one paint color or gloss level will be selected for same substrate within designated interior rooms or exterior areas.
         2) Color Level III:
            (a) Number and placement of interior and exterior paint colors and gloss levels shall be Color Level III from MPI Manual, PDCA P3-93 as modified in following paragraph.
            (b) Several paint colors or gloss levels will be selected for same substrate within designated interior rooms or exterior areas.

C. Materials:
   1. Materials used for any painting system shall be from single manufacturer unless approved otherwise in writing by painting system manufacturers and by Architect. Include manufacturer approvals in Product Data submittal.
   2. Linseed oil, shellac, turpentine, and other painting materials shall be pure, be compatible with other coating materials, bear identifying labels on containers, and be of highest quality of an approved manufacturer listed in MPI manuals. Tinting color shall be best grade of type recommended by Manufacturer of paint or stain used on Project.

### 2.02 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

**2.03 PAINT SYSTEMS - EXTERIOR**

A. Manufacturers: Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
   1. New Surfaces: Use MPI(a) EXT 5.1M Waterborne Light Industrial Coating system.
   2. Previously Finished Surfaces: Use MPI(r) REX 5.1K Waterborne Light Industrial Coating.

B. Exterior Ferrous Metal:
   1. Materials:
      a. All paints and coatings.
         1) Primer Coat: MPI Product 107, ‘Primer, Rust-Inhibitive, Water Based’.
         2) Finish Coats: MPI Product 163, ‘Light Industrial Coating, Exterior, Water Based, Semi-Gloss (MPI Gloss Level 5).
      b. Traffic signage:
         1) Primer Coat: MPI Product 107, ‘Primer, Rust-Inhibitive, Water Based’.
         2) Finish Coats: MPI Product 163, ‘Light Industrial Coating, Exterior, Water Based, Semi-Gloss (MPI Gloss Level 5).
   2. Design Criteria:
      a. Systems specified are in addition to prime coats provided under other Sections of Project Manual.
      b. Finish Requirements: Use MPI Premium Grade finish requirements for work of this Section.
      c. Gloss / Sheen Level Required: Gloss Level 5.

C. Exterior Galvanized Metal:
   1. Materials:
      a. Polyurethane:
         1) Vinyl Wash Primer Coat: MPI Product 80: ‘Primer, Vinyl Wash’.
         2) Finish Coats:
            (a) Epoxy MPI Product 101: ‘Primer, Epoxy, Anti-Corrosive, for Metal’.
            (b) Polyurethane MPI Product 72: ‘Polyurethane, Two-Component, Pigmented, Gloss (MPI Gloss Level 6-7)’.
      b. Latex:
         1) Waterborne Primer Coat: MPI Product 134: ‘Primer, Galvanized, Water Based’.
         2) Finish Coats: MPI Product 11: ‘Latex, Exterior Semi-Gloss (MPI Gloss Level 5)’.
   2. Handrails And Exposed Miscellaneous Structural Steel:
      a. New Surfaces: Use MPI(a) EXT 5.3D Pigmented Polyurethane Finish system.
      b. Previously Finished Work: Use MPI(r) REX 5.3D Pigmented Polyurethane Finish system.
   3. All Other:
      a. New Surfaces: Use MPI(a) EXT 5.3H Latex Finish system.
      b. Previously Finished Surfaces: Use MPI(r) REX 5.3H Latex Finish system.

D. Exterior CMU, Concrete and Stucco:
   1. Materials:
      a. Block Filler, New CMU Only: MPI Product 4: ‘Block Filler, Latex, Interior/Exterior’.
      b. Finish Coats: MPI Product 10: ‘Latex, Exterior Flat (MPI Gloss Level 1-2)’.
      c. Accent Stripe: MPI Product 164: 'Light Industrial Coating, Exterior, Water Based, Gloss (MPI Gloss Level 6)'.
   2. Performance:
      a. Finish Requirements:
         1) New Surfaces: MPI Premium Grade finish requirements.
         2) Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.

3) Sound Existing Surfaces: MPI Custom Grade finish requirements.
4) Gloss / Sheen Level Required: Gloss Level 1.

b. Concrete:
1) New Surfaces: Use MPI(a) EXT 3.1A Latex Finish system.
2) Previously Finished Surfaces: Use MPI(r) REX 3.1A Latex Finish system.

c. Stucco:
1) New Surfaces: Use MPI(a) EXT 3.1A Latex Finish system.
2) Previously Finished Surfaces: Use MPI(r) REX 3.1A Latex Finish system.

d. CMU:
1) New Surfaces: Use MPI(a) EXT 4.2A Latex Finish system.
2) Previously Finished Surfaces: Use MPI(r) REX 4.2A Latex Finish system.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Protection Of In-Place Conditions:
1. Protect other finish work and adjacent materials during painting. Do not splatter, drip, or paint surfaces not intended to be painted. These items will not be spelled out in detail but pay special attention to the following:
a. Do not paint finish copper, bronze, chromium plate, nickel, stainless steel, anodized aluminum, or monel metal except as explicitly specified.

B. Do not begin application of paints and finishes until substrates have been properly prepared.

C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Verification of Conditions:
1. Directing applicator to begin painting and coating work will indicate that substrates to receive painting and coating materials have been previously inspected as part of work of other Sections and are complete and ready for application of painting and coating systems as specified in those Sections.

H. Pre-Installation Testing:
1. Before beginning work of this Section, examine, and test surfaces to be painted or coated for adhesion of painting and coating systems.
2. Report in writing to Architect of conditions that will adversely affect adhesion of painting and coating work.
3. Do not apply painting and coating systems until party responsible for adverse condition has corrected adverse condition.

I. Evaluation And Assessment:
1. Report defects in substrates that become apparent after application of primer or first finish coat to Architect in writing and do not proceed with further work on defective substrate until such defects are corrected by party responsible for defect.

J. 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. Exterior Plaster and Stucco: 12 percent.
2. Fiber Cement Siding: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

### 3.02 PREPARATION

A. Protection of In-Place Conditions:
   1. Protect other finish work and adjacent materials during painting. Do not splatter, drip, or paint surfaces not intended to be painted. These items will not be spelled out in detail but pay special attention to the following:
      a. Do not paint finish copper, bronze, chromium plate, nickel, stainless steel, anodized aluminum, or monel metal except as explicitly specified.

B. Surface Preparation:
   1. Prepare surfaces in accordance with MPI requirements and requirements of Manufacturer for each painting system specified, unless instructed differently in Contract Documents. Bring conflicts to attention of Architect in writing.
   2. Fill minor holes and cracks in wood surfaces to receive paint or stain.
   3. Surfaces to be painted shall be clean and free of loose dirt. Clean and dust surfaces before painting or finishing.
   4. Do no exterior painting while surface is damp, unless recommended by Manufacturer, nor during rainy or frosty weather. Interior surfaces shall be dry before painting. Moisture content of materials to be painted shall be within tolerances acceptable to Paint Manufacturer.
   5. Sand woodwork smooth in direction of grain leaving no sanding marks. Clean surfaces before proceeding with stain or first coat application.

C. Clean surfaces thoroughly and correct defects prior to application.

D. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

E. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

F. Seal surfaces that might cause bleed through or staining of topcoat.

**3.03 APPLICATION**

A. Interface with Other Work:
   1. Coordinate with other trades for materials and systems that require painting before installation.
   2. Schedule painting and coating work to begin when work upon which painting and coating work is dependent has been completed. Schedule installation of pre-finished and non-painted items, which are to be installed on painted surfaces, after application of final finishes.

B. Paint or finish complete all surfaces to be painted or coated as described in Contract Documents, including but not limited to following items.

C. Apply sealant in gaps 3/16 inch (5 mm) and smaller between two substrates that are both to be painted or coated. Sealants in other gaps furnished and installed under Section 07 9200.

D. On wood to receive a transparent finish, putty nail holes in wood after application of stain using natural colored type to match wood stain color. Bring putty flush with adjoining surfaces.

E. In multiple coat paint work, tint each succeeding coat with slightly lighter color, but approximating shade of final coat, so it is possible to check application of specified number of coats. Tint final coat to required color.

F. Spread materials smoothly and evenly. Apply coats to not less than wet and dry film thicknesses and at spreading rates for specified products as recommended by Manufacturer.

G. Touch up suction spots after application of first finish coat.

H. Paint shall be thoroughly dry and surfaces clean before applying succeeding coats.

I. Use fine sandpaper between coats as necessary to produce even, smooth surfaces.

J. Make edges of paint adjoining other materials or colors clean, sharp, and without overlapping.

K. Finished work shall be a 'Properly Painted Surface' as defined in this Section.

L. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

M. 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.

N. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

O. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

P. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

Q. Apply each coat to uniform appearance.

R. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

S. Exterior Ferrous Metal:
   1. New Surfaces: Clean metal to be painted of rust, mill scale, grease, oil, and welding spatters, burrs, flux, slag, and fume. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying primer coat.
   2. Existing Painted Surfaces:
      a. Remove deteriorated and chalked existing paint and rust down to sound substrate by scraping or power tools.
      b. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying primer coat.
      c. Spot prime bare metal surfaces followed by a prime coat over entire surface to be painted.
      d. Lightly sand entire surface.
      e. Clean surface as recommended by Paint Manufacturer.
      f. Apply specified finish coats.

T. Exterior Galvanized Metal:
   1. New Surfaces:
      a. Clean 'passivated' or 'stabilized' galvanized steel as specified in SSPC-SP 1.
      b. After removal of 'passivated' or 'stabilized' coating or for surfaces without coating, clean surfaces to be painted with mineral spirits or product recommended by Paint Manufacturer. Change to clean rags or wiping cloths regularly to reduce possibility of re-contamination of surface.
      c. Apply prime coat.
      d. Apply finish coats.
   2. Existing Painted Surfaces:
      a. Remove deteriorated and chalked existing paint and rust deposits down to sound substrate by sanding, scraping, or wire brushing.
      b. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer.
      c. Apply prime coat.
      d. Apply finish coats.
   3. Existing Unpainted Surfaces:
      a. Wire brush or power wash as necessary to remove 'white rust'.
      b. Apply prime coat.
      c. Apply finish coats.

U. Exterior CMU, Concrete, Stucco
   1. New Surfaces:

a. On highly porous surfaces when weather is exceptionally hot and dry, it may be desirable to dampen surface before applying first coat of an emulsion paint.
b. Completely cover voids in masonry block.
c. Roll after spraying if necessary to eliminate pinholing.

2. Existing Unpainted Surfaces:
a. Power wash surfaces to be painted.
b. Fill cracks with masonry crack filler.
c. Apply block filler and finish coat as required for new work.

**3.04 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Non-Conforming Work:
1. Correct deficiencies in workmanship as required to leave surfaces in conformance with 'Properly Painted Surface,' as defined in this Section.
2. Correction of 'Latent Damage' and 'Damage Caused By Others,' as defined in this Section, is not included in work of this Section.

**3.05 CLEANING**

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. As work proceeds and upon completion of work of any painting Section, remove paint spots from floors, walls, glass, or other surfaces and leave work clean, orderly, and in acceptable condition.

C. Waste Management:
1. Remove rags and waste used in painting operations from building each night. Take every precaution to avoid danger of fire.
2. Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be disposed of subject to regulations of applicable authorities having jurisdiction.
3. Remove debris caused by work of paint Sections from premises and properly dispose.
4. Retain cleaning water and filter out and properly dispose of sediments.

**3.06 PROTECTION**

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

**3.07 SCHEDULE OF PAINT COLORS**

A. Exterior:
1. Color Quality Standards. See Section 01 6000:
a. Exterior Metal :
1) [Insert Product and Color] by [Insert Manufacturer].
b. Exterior CMU, Concrete:
1) [Insert Product and Color] by [Insert Manufacturer].
c. Exterior Stucco:
1) [Insert Product and Color] by [Insert Manufacturer].
d. Exterior Wood:
1) [Insert Product and Color] by [Insert Manufacturer].

**END OF SECTION 09 9113**

**SECTION 09 9123**
**INTERIOR PAINTING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. 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. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
   10. Glass.
   11. Concrete masonry units in utility, mechanical, and electrical spaces.
   12. Acoustical materials, unless specifically indicated.
   13. Concealed pipes, ducts, and conduits.

### 1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

### 1.03 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Schedule painting pre-installation conference after delivery of paint or coatings and before or at same time as application of field samples.
      a. Coordinate pre-installation conferences of all related painting and coating Sections under 09 9000 heading ‘Paints and Coatings’.
      b. Schedule conference before preparation of control samples as specified in Sections under 09 9000 heading ‘Paints and Coatings’.
      c. Conference to be held at same time as Section 09 2116 to review gypsum board finish preparation.
   2. In addition to agenda items specified in Section 01 3000, review following:
      a. Review Quality Assurance for Approval requirements.
      b. Review Quality Assurance Field Sample requirements.
      c. Review Submittal requirements for compliance for MPI Approved Products.
      d. Review Design Criteria requirements.
      e. Review Cleaning requirements.
      f. Review painting schedule.

g. Review safety issues.

3. Review additional agenda items from Sections under 09 9000 heading ‘Paints and Coatings’.

## 1.05 SUBMITTALS

A. 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. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

B. Samples: Submit two paper "draw down" samples, 4 x 6 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, submit each color in each sheen available.

C. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturer’s documentation:
            (a) Manufacturer's cut sheet for each component of each system.
            (b) Schedule showing rooms and surfaces where each system was used.

## 1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.
   1. Minimum five (5) satisfactorily completed projects of comparable quality, similar size, and complexity in past three (3) years before bidding.
   2. Maintain qualified crew of painters throughout duration of the Work.
   3. Upon request, submit documentation.

## 1.07 MOCK-UP

A. Before application of any paint system, meet on Project site with Architect, Owner's representative, and Manufacturer's representative. Architect may select one (1) surface for application of each paint system specified. This process will include establishing acceptable substrate conditions required for Project before application of paints and coatings.

B. Apply paint systems to surfaces indicated by Architect following procedures outlined in Contract Documents and Product Data submission specified above.

C. After approval of samples, proceed with application of paint system throughout Project. Approved samples will serve as standard of acceptability.

## 1.08 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.

# PART 2 PRODUCTS

## 2.01 PERFORMANCE AND DESIGN CRITERIA

A. Regulatory Agency Sustainability Approval:

1. Conform to work place safety regulations and requirements of those authorities having jurisdiction for storage, mixing, application and disposal of all paint and related hazardous materials.
2. Paint and painting materials shall be free of lead and mercury, and have VOC levels acceptable to local jurisdiction.
3. Master Painters Institute (MPI) Standards:
    a. Products: Comply with MPI standards indicated and listed in 'MPI Approved Products List'.
    b. Preparation and Workmanship: Comply with requirements in 'MPI Architectural Painting Specification Manual' for products and coatings indicated.

**2.02 MANUFACTURERS**

A. Provide products indicated from one of the following. Alternate products must be approved by Architect prior to bid. Alternate products must meet specified criteria and be listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
    1. Benjamin Moore and Company: www.benjaminmoore.com.
        a. National Account Representative: Doug Summers, Doug.Summers@Benjaminmoore.com , (801) 721-6380
    2. PPG Industries: www.ppgpaints.com
        a. Specification and design Representative: Ryan Henrie, rhenrie@ppg.com, (435) 817-3011.
        b. Corporate Account Manager: Vito Anteri, vfanteri@ppg.com (480) 6665-9769.
            1) Use Account #322073990000 for access to special pricing.
    3. Sherwin-Williams Company: www.sherwin-williams.com.
        a. National Account Representative: Mike Koncilja, mike.k@sherwin.com ,
        b. Account Representative: Todd W. Taylor, todd.w.taylor@sherwin.com ,
        c. Architectural Account Executive: Richard Condie, Richard.condie@sherwin.com
        d. Director-Enterprise Specifications: Carson Cradduck, carson.cradduck@sherwin.com
    4. Contact Account Representative before acquiring paint to ensure required acquistion process is followed.

**2.03 PAINTS AND FINISHES - GENERAL**

A. Ready-mixed, unless intended to be a field-catalyzed paint.
    1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
    2. 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.
    3. 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.
    4. 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.
    5. Supply each paint material in quantity required to complete entire project's work from a single production run.
    6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

**2.04 PAINT SYSTEMS - INTERIOR**

A. Interior Poured Concrete:
    1. Materials:
        a. MPI Product 60" 'Floor Paint, Latex, Low Gloss' (or):
            1) N122 Floor & Patio Low Sheen Enamel Floor Coating by Benjamin Moore

2) 3-510XI Series PPG Floor & Porch Enamel Interior/Exterior 100% Acrylic Latex Satin
3) B90A102 Armorseal Tread Plex Water Based Acrylic Floor Coating by Sherwin Williams

2. Performance:
   a. Design Criteria:
      1) Gloss / Sheen Level Required: Semi-Gloss.
   b. New Surfaces: Use MPI(a) INT 3.2A Latex Finish system (or products listed above).
   c. Previously Finished Surfaces: Use MPI(r) RIN 3.2A Latex Finish system (or products listed above).
   d. Finish Requirements: Use MPI Custom Grade finish requirements.

B. Interior Gypsum Board and Plaster:
1. Materials:
   a. Primers:
      1) MPI Product 50, 'Primer Sealer, Latex, Interior' (or):
         (a) N534 Ultra Spec 500 Interior Latex Primer by Benjamin Moore
         (b) 6-4900xi PPG Speedhide Zero Interior Latex Primer by PPG Paints.
         (c) B28W02600 ProMar 200 Zero Interior Latex Primer by Sherwin Williams.
   b. Finish Coats:
      1) Restrooms And Custodial Rooms:
         (a) Buildings with only Gypsum Board surfaces in rooms:
         (b) MPI Product 115, 'Epoxy-Modified Latex, Interior, Gloss (MPI Gloss Level 6)' (or):
            (1) Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss by Benjamin Moore.
            (2) Aquapon WB EP 98E-X/98E-98 Waterborne Catalyzed Semi-Gloss Epoxy by PPG Paints.
            (3) B73W311 Pro Industrial Waterbased Catalyzed Epoxy by Sherwin Williams.
         (c) Buildings with CMU and Gypsum Board surfaces in same rooms:
         (d) MPI Product 77, 'Epoxy, Gloss' (or):
            (1) Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss by Benjamin Moore.
            (2) Aquapon WB EP 98E-X/98E-98 Waterborne Catalyzed Semi-Gloss Epoxy by PPG Paints.
            (3) B73W311 Pro Industrial Waterbased Catalyzed Epoxy by Sherwin Williams.
      2) Remaining Painted Surfaces:
         (a) Walls/Partitions/Vertical Surfaces - MPI Product 141, 'Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level 5)' (or):
            (1) Ultra Spec 500 Latex Semi-Gloss by Benjamin Moore.
            (2) 6-5510 PPG Speedhide Zero Interior Latex Semi-Gloss by PPG Paints.
            (3) ProMar 200 Zero VOC HP Latex Semi-Gloss by Sherwin Williams.
         (b) Ceilings - MPI Product 143 'Latex, Interior, High Performance Architectural, Flat (MPI Gloss Level 1 or 2)' (or):
            (1) T535 Ultra Spec 500 Interior Latex Flat by Benjamin Moore.
            (2) 6-4110xi PPG Speedhide Zero Interior Latex Flat by PPG Paints.
            (3) ProMar 200 Zero VOC Interior Latex Flat by Sherwin Williams.
2. Performance:
   a. Design Criteria:
      1) New Surfaces: MPI Premium Grade finish requirements.
      2) Gloss / Sheen Required:

(a) Restrooms And Custodial Rooms: Gloss Level 6.
(b) Remaining Painted Surfaces: Gloss Level 5.

b. Restrooms And Custodial Rooms:
1) New Surfaces: Use MPI(a) INT 9.2E Waterborne Epoxy Finish system (or products listed above).

c. All Other:
1) New Surfaces: Use MPI(a) INT 9.2B Latex Finish system (or products listed above).

C. Interior Metal:
1. Materials:
a. All paints and coatings shall comply with VOC content limits as indicated in section 01 8113
1) Primers:
(a) Ferrous Metal: MPI Product 107, 'Primer, Rust-Inhibitive, Water Based' (or):
(1) Ultra Spec HP Acrylic Metal Primer by Benjamin Moore.
(2) PPG Pitt-Tech Plus 4020PF / 90-19XX series Waterborne Acrylic Primer/Finish by PPG Paints.
(3) Pro-Cryl Universal Primer by Sherwin Williams.
(b) Galvanized Metal: MPI Product 134: 'Primer, Galvanized, Water Based' (or):
(1) Ultra Spec HP Acrylic Metal Primer by Benjamin Moore.
(2) PPG Pitt-Tech Plus 4020PF / 90-19XX series Waterborne Acrylic Primer/Finish by PPG Paints.
(3) Pro-Cryl Universal Primer by Sherwin Williams.
(c) Aluminum: MPI Product 134: 'Primer, Quick Dry, for Aluminum' (or):
(1) Ultra Spec HP Acrylic Metal Primer by Benjamin Moore.
(2) PPG Pitt-Tech Plus 4020PF / 90-19XX series Waterborne Acrylic Primer/Finish by PPG Paints.
(3) Pro-Cryl Universal Primer by Sherwin Williams.
2) Finish Coats: MPI Product 153: 'Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)' (or):
(a) V341 Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss by Benjamin Moore.
(b) 16-1510 PPG Pitt-Glaze WB1 Waterborne Pre-Catalyzed Semi-Gloss Epoxy by PPG Paints.
(c) B73W311 Pro Industrial Waterbased Catalyzed Epoxy by Sherwin Williams.

2. Performance:
a. Design Requirements:
1) New Surfaces: MPI Premium Grade finish requirements.
2) Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
3) Sound Existing Surfaces: MPI Custom Grade finish requirements.
4) Gloss / Sheen Level Required: Gloss Level 5.

b. Ferrous Metal:
1) New Surfaces: Use MPI(a) INT 5.1B Waterborne Light Industrial Finish system (or products listed above).
2) Previously Finished Surfaces: Use MPI(r) RIN 5.1B Waterborne Light Industrial Finish system (or products listed above).

c. Galvanized Metal:
1) New Surfaces: Use MPI(a) INT 5.3J Latex Finish system (or products listed above).
2) Previously Finished Surfaces: Use MPI(r) RIN 5.3AH Latex Finish system (or products listed above).

d. Aluminum:

1) New Surfaces: Use MPI(a) INT 5.4E Waterborne Light Industrial Finish system (or products listed above).
2) Previously Finished Surfaces: Use MPI(r) REX 5.4E Light Industrial Finish system (or products listed above).

D. Locations indicated as Epoxy:
1. Materials
a. Wall and Ceiling Surfacing System:
1) Interior Primer:
(a) Approved Product. See Section 01 6000:
(b) 6-4 PPG Speedhide MaxPrime High Build Interior Latex Primer/Surfacer by PPG Paints.
(c) B28W601 PrepRite High Build Interior Latex Primer/Surfacer by Sherwin-Williams.
2) Epoxy:
(a) Color: White.
(b) Approved Product. See Section 01 6000:
(c) 16-1510 PPG Pitt-Glaze WB1 Waterborne Pre-Catalyzed Semi-Gloss Epoxy by PPG Paints.
(d) B71W111 Pro Industrial HI-BLD Water-based Catalyzed Epoxy by Sherwin-Williams

## 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.

### 3.02 PREPARATION

A. Protection of In-Place Conditions:
1. Protect other finish work and adjacent materials during painting. Do not splatter, drip, or paint surfaces not intended to be painted. These items will not be spelled out in detail but pay special attention to the following:
a. Do not paint finish copper, bronze, chromium plate, nickel, stainless steel, anodized aluminum, or monel metal except as explicitly specified.
b. Keep cones of ceiling speakers completely free of paint. In all cases where painting of metal speaker grilles is required, paint without grilles mounted to speakers and without grilles on ceiling.

B. Surface Preparation:
1. Prepare surfaces in accordance with MPI requirements and requirements of Manufacturer for each painting system specified, unless instructed differently in Contract Documents. Bring conflicts to attention of Architect in writing.
2. Fill minor holes and cracks in wood surfaces to receive paint or stain.
3. Surfaces to be painted shall be clean and free of loose dirt. Clean and dust surfaces before painting or finishing.
4. Do no exterior painting while surface is damp, unless recommended by Manufacturer, nor during rainy or frosty weather. Interior surfaces shall be dry before painting. Moisture content of materials to be painted shall be within tolerances acceptable to Paint Manufacturer.
5. Sand woodwork smooth in direction of grain leaving no sanding marks. Clean surfaces before proceeding with stain or first coat application.

C. Clean surfaces thoroughly and correct defects prior to application.

D. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

E. Remove or repair existing paints or finishes that exhibit surface defects.

F. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

G. Seal surfaces that might cause bleed through or staining of topcoat.

H. Interior Poured Concrete:
   1. New Surfaces:
      a. Prep according to manufacturer's instructions.
      b. Apply prime coat.
      c. Apply finish coats.
   2. Existing Painted Surfaces:
      a. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Acid etch bare concrete areas, if necessary.
      b. Clean floors as recommended by Paint Manufacturer.
      c. Apply coating system.

I. Interior Gypsum Board and Plaster:
   1. Interface With Other Work: Properly clean and paint light cove interiors before installation of light fixtures.
   2. New Surfaces:
      a. Primer: Apply primer to be covered with other paint coats with roller only, or with spray gun and back-rolled.
   3. Existing Painted Surfaces:
      a. Remove deteriorated existing paint down to sound substrate by scraping or sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces.
      b. Clean surface with mild soap and water, or with tri-sodium phosphate (TSP). Wash surfaces that have been defaced with marking pens, crayons, lipstick, etc, with solvent recommended by Paint Manufacturer. Spot prime such surfaces.
      c. Spackle and tape cracks. Sand to smooth finish and spot prime.
      d. Sand or chemically etch existing painted surface as required to prepare surface to accept new paint.
      e. Re-clean surface.
      f. Apply primer coat.
      g. Apply finish coats.

J. Interior Metal:
   1. New Surfaces: Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
   2. Existing Painted Surfaces:
      a. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Spot prime bare metal surfaces immediately.
      b. Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
      c. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer.
      d. Apply prime coat over entire surface to be painted.
      e. Lightly sand entire surface.
      f. Clean surface as recommended by Paint Manufacturer.

g. Apply finish coats.

K. Interior Wood:
1. New Surfaces:
a. Spot prime nail holes, cracks, and blemishes before and after puttying.
b. Apply stain blocker or other product recommended by Paint Manufacturer to knots before applying primer coat.
2. Existing Painted Surfaces:
a. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Spot prime bare wood areas on woodwork.
b. Wash surfaces that have been defaced with marking pens, crayons, lipstick, etc, with solvent recommended by Paint Manufacturer. Spot prime such surfaces.
c. Apply finish coats.

**3.03 APPLICATION**

A. Interface with Other Work:
1. Coordinate with other trades for materials and systems that require painting before installation.
2. Schedule painting and coating work to begin when work upon which painting and coating work is dependent has been completed. Schedule installation of pre-finished and non-painted items, which are to be installed on painted surfaces, after application of final finishes.

B. Paint or finish complete all surfaces to be painted or coated as described in Contract Documents, including but not limited to following items.

C. Apply sealant in gaps 3/16 inch (5 mm) and smaller between two substrates that are both to be painted or coated. Sealants in other gaps furnished and installed under Section 07 9200.

D. On wood to receive a transparent finish, putty nail holes in wood after application of stain using natural colored type to match wood stain color. Bring putty flush with adjoining surfaces.

E. In multiple coat paint work, tint each succeeding coat with slightly lighter color, but approximating shade of final coat, so it is possible to check application of specified number of coats. Tint final coat to required color.

F. Spread materials smoothly and evenly. Apply coats to not less than wet and dry film thicknesses and at spreading rates for specified products as recommended by Manufacturer.

G. Touch up suction spots after application of first finish coat.

H. Paint shall be thoroughly dry and surfaces clean before applying succeeding coats.

I. Use fine sandpaper between coats as necessary to produce even, smooth surfaces.

J. Make edges of paint adjoining other materials or colors clean, sharp, and without overlapping.

K. Finished work shall be a 'Properly Painted Surface' as defined in this Section.
1. Finish casework and wood trims that are specified to be installed under Section 06 2000 and that are not called out to be factory-or shop-finished. Back prime wood elements to be installed against concrete or masonry or that may be subjected to moisture.
2. Paint mechanical, electrical, and audio/visual items that require field painting as indicated in Contract Documents. These include but are not limited to:
a. Gas pipe from gas meter into building.
b. Mechanical flues and pipes penetrating roof.
c. Electrical panel and disconnect enclosures.
d. Metal protective structures for refrigerant lines.
3. Metal reveals at ceiling access doors.
4. Paint inside of chases in occupied spaces flat black for 18 inches (450 mm) or beyond sightline, whichever is greater.
5. Paint surfaces in organ chamber behind grille cloth with flat black paint.

L. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

M. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

N. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

O. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

P. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

Q. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

R. Sand wood and metal surfaces lightly between coats to achieve required finish.

S. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

T. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

## 3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Non-Conforming Work:
   1. Correct deficiencies in workmanship as required to leave surfaces in conformance with 'Properly Painted Surface,' as defined in this Section.
   2. Correction of 'Latent Damage' and 'Damage Caused By Others,' as defined in this Section, is not included in work of this Section.

## 3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. As work proceeds and upon completion of work of any painting Section, remove paint spots from floors, walls, glass, or other surfaces and leave work clean, orderly, and in acceptable condition.

C. Waste Management:
   1. Remove rags and waste used in painting operations from building each night. Take every precaution to avoid danger of fire.
   2. Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be disposed of subject to regulations of applicable authorities having jurisdiction.
   3. Remove debris caused by work of paint Sections from premises and properly dispose.
   4. Retain cleaning water and filter out and properly dispose of sediments.

## 3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

## 3.07 SCHEDULE OF PAINT COLORS

A. Interior:
   1. Interior Poured Concrete (See Section 09 9123):
      a. Color Quality Standard. See Section 01 6000:
         1) [Insert Product and Color] by [Insert Manufacturer].
   2. Interior Clear Finished Wood (See Section 09 9300):
      a. Match other interior clear finished wood building elements.

3. Interior Gypsum Board, Plaster (See Section 09 9123):
    a. Color Quality Standard. See Section 01 6000:
        1) Cherry / Blue: SW6070 by Sherwin Williams or PPG 1021-1 Mountain Gray by PPG Paints
        2) Cherry / Green: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        3) Cherry / Red: SW6070 by Sherwin Williams or PPG 1021-1 Mountain Gray by PPG Paints
        4) OAK 95 / Blue: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        5) OAK 95 / Green: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        6) OAK 95 / Red: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
4. Interior Metal (See Section 09 9123):
    a. Color Quality Standard. See Section 01 6000:
        1) Cherry / Blue: SW6070 by Sherwin Williams or PPG 1021-1 Mountain Gray by PPG Paints
        2) Cherry / Green: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        3) Cherry / Red: SW6070 by Sherwin Williams or PPG 1021-1 Mountain Gray by PPG Paints
        4) OAK 95 / Blue: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        5) OAK 95 / Green: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        6) OAK 95 / Red: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
5. Interior Painted Wood (See Section 09 9123):
    a. Color Quality Standard. See Section 01 6000:
        1) Cherry / Blue: SW6070 by Sherwin Williams or PPG 1021-1 Mountain Gray by PPG Paints
        2) Cherry / Green: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        3) Cherry / Red: SW6070 by Sherwin Williams or PPG 1021-1 Mountain Gray by PPG Paints
        4) OAK 95 / Blue: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        5) OAK 95 / Green: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints
        6) OAK 95 / Red: SW6098 by Sherwin Williams or PPG 1078-2 Water Chestnut by PPG Paints

**END OF SECTION 09 9123**

## SECTION 09 9300
## STAINING AND TRANSPARENT FINISHING

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

### 1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

### 1.03 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

C. KCMA A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets 2017.

D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Participate in pre-installation conference as specified in Section 09 9123.
   2. In addition to agenda items specified in Section 01 3100 and Section 09 9001, review following:
      a. Review control sample(s).

### 1.05 SUBMITTALS

A. 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.
   2. MPI product number (e.g. MPI #33).
   3. Manufacturer's installation instructions.

B. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, 4 by 6 inch in size.
   1. Sample will be used as performance standard for evaluating finish provided.

C. Finish Manufacturer's literature or certification that finish material meets requirements of ANSI / KCMA A161.1.

### 1.06 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 stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish 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.

### 1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

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 Temperature: 50 degrees F unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## PART 2 PRODUCTS

### 2.01 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:
1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide finishes 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.
3. 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.
4. Supply each finish material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

### 2.02 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Stain: MPI 90, 'Stain, Semi-Transparent, for Interior Wood'.
1. Clear Finish Coats:
   a. Field Finished:
      1) Chemcraft International Inc:
         (a) First, Second, And Third Coats: 20 Sheen Opticlear Pre-Catalyzed Lacquer.
      2) ICI Dulux / Trinity:
         (a) First Coat: ICE Vinyl Sanding Sealer.
         (b) Second And Third Coats: ICI Pre-Catalyzed Lacquer.
      3) Lilly / Valspar:
         (a) First, Second, And Third Coats: 20 Sheen Pre-Catalyzed Lacquer 587E208.
      4) Sherwin-Williams:
         (a) First Coat: T67F3 Vinyl Sealer.
         (b) Second And Third Coats: T77F38 Sherwood Pre-Catalyzed Lacquer DRE.
   b. Mill Finished: Architectural Woodwork finished in a mill may use one (1) coat of Vinyl Sealer and two (2) coats of Conversion Varnish (vinyl sealer not required if required thickness can be achieved without) or three (3) coats of Conversion Varnish from one (1) of the approved Finish Manufacturers, or approved equal, as recommended by Finish Manufacturer.
   c. Products meeting testing requirements for finishes of ANSI / KCMA A161.1 may be used upon approval of submission by Architect before use.
2. Color:
   a. Design Criteria:
      1) Finish to match Owner selected sample.

(a) Oak 95:
(1) Performance standard: Owner provided sample.
(2) Contact Information: Michael Jensen (801) 240-3367 jensonmb@churchofjesuschrist.org, Meetinghouse Facilities Department.
(b) Cherry:
(1) Performance standard: Owner provided sample.
(2) Contact Information: Michael Jensen (801) 240-3367 jensonmb@churchofjesuschrist.org, Meetinghouse Facilities Department.

2) Elective finishing process:
(a) Approved Products: See Section 01 6200.
(1) Cherry stain: S4XXR1093 by Sherwin Williams.
(2) Sealer: V81FH4 by Sherwin Williams.
(b) Option One Toner:
(1) Toner: T7XXN11343 by Sherwin Williams.
(c) Option Two Toner:
(1) 1 qt (0.946 liter) cherry stain.
(2) 2 qts (1.893 liter) sealer.
(3) 6 qts (5.678 liter) lacquer thinner.
(4) Red oxide 42.8 grams.
(5) Black 25.0 grams.
(6) Medium yellow 30 grams.
(d) Finish:
(1) Finish: V84FF8007 by Sherwin Williams.
(e) Application:
(1) Use quart spray pot. Apply gently and lightly to surface.
(2) Use control sample at all times.
(3) Spray on stain and let stand five (5) minutes before wiping off. Let dry sixteen (16) hours (or overnight).
(4) Use sealer and let dry one (1) hour.
(5) Buff surfaces with 220 grit sanding sponge blocks.
(6) Blow off dust.
(7) Spray on toner (let dry thirty (30) minutes minimum).
(8) Spray on finish.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Do not begin application of stains 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 effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. 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. 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 repair existing finishes that exhibit surface defects.

## 3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

H. General:
   1. See appropriate paragraphs of Section 09 9001.
   2. Sand entire exposed surface of item to be finished lightly with 120 to 150 non-stearated sandpaper and clean before applying dye or stain.
   3. Apply stain in accordance with Manufacturer's recommendations and as necessary to attain correct color.
   4. Scuff sand with 220 non-stearated sandpaper between application of application stain and first finish coat.
   5. If wood is finished before installation, finish cut ends and other unfinished, exposed surfaces same as previously finished surfaces after installation of wood.

I. Where back-priming is required, apply one coat of finish material.

J. Architectural Woodwork Door Surfaces (cabinetry doors only):
   1. Finish tops, bottoms, and edges before faces.
   2. Finish architectural woodwork doors with no hardware applied to doors.

## 3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

## 3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**

## SECTION 10 1100
## VISUAL DISPLAY UNITS

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Glass markerboards.

B. Display Cases

C. Tackboards.

## 1.02 REFERENCE STANDARDS

A. FS CCC-W-408 - Wall Covering, Vinyl-Coated Revision D.

## 1.03 SUBMITTALS

A. Product Data: Provide manufacturer's data on installation instructions, markerboard, tackboard surface covering, trim, and accessories.

B. Manufacturer's printed installation instructions.

C. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance instructions.
         2) Printed cleaning instructions.
      b. Warranty Documentation:
         1) Manufacturer Warranty.
      c. Record Documentation:
         1) Manufacturer’s documentation:
            (a) Manufacturer’s product literature.
            (b) Color selections.

D. Maintenance Data: Include data on regular cleaning, stain removal.

## 1.04 WARRANTY

A. Provide manufacturer warranty to include warranty against faulty workmanship and materials, discoloration due to cleaning, crazing or cracking, and staining.

# PART 2 PRODUCTS

## 2.01 OWNER FURNISHED FIXED MARKERBOARDS

A. Approved Manufacturers. See Section 01 6000:
   1. Quartet, www.quartet.com.

B. Fabrication:
   1. Furnish printed cleaning instructions with each shipment.

## 2.02 OWNER FURNISHED TACK BOARDS

A. Manufacturer:

B. Fabrication:
   1. Prefabricate units at factory and ship to jobsite in one piece.
   2. Furnish printed cleaning instructions with each shipment.

## 2.03 OWNER FURNISHED DISPLAY CASES

A. Approved Manufacturers. See Section 01 6000:
   1. ADP Lemco Corp, Draper, UT www.adplemco.com.

B. Missionary Display Cases:
   1. Size: 48 inches by 48 inches (1200 mm by 1200 mm).
   2. Sliding Glass Doors: 1/4 inch (6 mm) tempered polished plate.
   3. Locks: Standard of Manufacturer. Provide four (4) keys.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive-applied boards.

### 3.02 PREPARATION

A. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.

B. Remove switchplates, wall plates, and surface-mounted fixtures where tackable wall paneling is applied. Reinstall items on completion of installation.

C. 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 boards in accordance with manufacturer's printed installation instructions.

B. Secure units level and plumb.

C. Shim as necessary to provide permanent installation and smooth operation.

D. Anchor concealed hangers with screws at 24 inches (600mm)

E. Butt Joints: Install with tight hairline joints.

F. Carefully cut holes in boards for thermostats and wall switches.

G. Mounting fasteners shall penetrate framing lumber or blocking 1-1/2 inch (38 mm) minimum. Use toggle bolts or expansion bolts in masonry walls.

H. After attaching map clips, apply permanently attached end cap or screw to prevent removal of map clips.

### 3.04 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

**END OF SECTION**

## SECTION 10 1400
## SIGNAGE

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Interior directional and informational signs.

B. Building identification signs.

C. Traffic signs.

## 1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

## 1.03 SUBMITTALS

A. 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.

B. 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. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

C. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

## 1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Sign shall meet ANSI A117.1 accessibility code and ADA standards for accessible design and local and state authorities having jurisdiction (AHJ) requirements.

## 1.05 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.

## 1.06 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 SIGNAGE APPLICATIONS

A. Engraved Stone Panel Signage:
   1. Fabricators:
      a. Approved Sign Fabricators. See Section 01 6000:

1) Hans Monument Co, Salt Lake City, UT www.hansmonuments.com.
   (a) Contact Information: Tanya Hardy (801) 484-1594 or fax (801) 467-8308. Email: hansmonuments@gmail.com
2) Mark H. Bott Co., Ogden, UT www.markbottco.com.
   (a) Contact Information: David E. Bott (801) 393-8087 or fax (801) 393-8080.

2. Stone:
   a. Description:
      1) Stone building sign(s).
   b. Design Criteria:
      1) Texture and color variation shall be within limits established by Architect's approved sample.
      2) Monument quality, free of defects that would materially impair strength, durability, and appearance.
   c. Dimensions:
      1) Meetinghouse building sign with Church logo and visitors welcome:
         (a) Approved sign dimension: 34-1/4 inches (870 mm) high by 55-5/8 inches (1 413 mm) wide by 1-1/4 inch (32 mm) thick as shown on Contract Drawings.
      2) Stone building address sign:
         (a) Approved sign dimension: 10-1/4 inches (260 mm) high by 15-5/8 inches (397 mm) wide (width may vary in dimension per numerals used in address) by 1-1/4 inch (32 mm) thick as shown on Contract Drawings. Contractor to provide correct address and provide SUBMITTAL with correct numerals to Sign Fabricator.
   d. Approved Stone Type. See Section 01 6200:
      1) Bethel White Granite.
      2) Elberton Sunset Granite.
      3) Morning Rose Granite.
      4) Medium Barre Granite.
3. Finish: Low pressure, 30 lb (13.6 kg), steeled finish on 80 grit honed surface.
4. Fasteners and Anchors:
   a. Provided by Sign Fabricator for method shown on Contract Documents:
      1) 'J' bolt system for mounting sign recessed in masonry veneer on framing or CMU.
      2) 'Z' bracket system for surface mounting sign on concrete or existing masonry.
5. Submittals:
   a. Action Submittals:
      1) Shop Drawings:
         (a) Show details of attachment system.
      2) Samples:
         (a) Submit stone sample of approved stone type specified by Architect.
   b. Informational Submittals:
      1) Approved Stone Type:
         (a) Notify Sign Fabricator of approved stone ten (10) week minimum before installation of sign(s).
      2) Stone building address sign:
         (a) Notify Sign Fabricator of correct address that will be used in address ten (10) week minimum before installation of sign.

6. Delivery, Storage, and Handling
    a. Delivery And Acceptance Requirements:
        1) Sign Fabricator Responsibility:
            (a) Deliver material to site, carefully unload, and check in such manner as to avoid soiling, damaging, or chipping.
            (b) Protect material from damage while in transit to job site.
    b. Storage And Handling Requirements:
        1) General Contractor Responsibility:
            (a) Store material on planks clear of ground.
            (b) Protect material from damage, dirt, or disfigurement until installation.
7. Installation:
    a. General:
        1) Set stone sign using mechanical fasteners provided by Sign Fabricator.
        2) Joints shall be 3/8 inch (9.5 mm) wide. Use plastic spacers in wall joints.
    b. Stone Damage:
        1) Installer responsible for repair of damaged surface during installation
8. Cleaning:
    a. General:
        1) After stone sign installation is completed, clean using non-metallic fiber brushes and clean water.
9. Protection:
    a. General Contractor Responsibility:
        1) Provide protection for stone sign(s) from masonry cleaning chemicals and other damaging materials until Substantial Completion.

B. Traffic Signage:
1. Permanently Mounted:
    a. Post Foundation Concrete: One cu ft cement, 2 cu ft (0.0566 cu m) sand, 4 cu ft (0.1132 cu m) gravel, and 5 gallons (18.93 liters) minimum to 6 gallons (22.71 liters) maximum of water.
    b. Post Setting Grout at Sleeves:
        1) Acceptable Products:
            (a) Normal Construction Grout A by Bonsal American, Charlotte, NC www.bonsal.com.
            (b) Advantage 1107 Grout by Dayton Superior Specialty Chemicals, Kansas City, KS www.daytonsuperiorchemical.com.
            (c) NS Grout by Euclid Chemical Co, Cleveland, OH www.euclidchemical.com 4) 5 Star Special Grout 110 by Five Star Products Inc, Fairfield, CT www.fivestarproducts.com.
            (d) Duragrout by L&M Construction Chemicals Inc, Omaha, NE www.lmcc.com 6) Sonneborn / BASF Building Systems, Shakopee, MN www.chemrex.com.
            (e) Tamms Grout 621 by TAMMS Industries, Mentor, OH www.tamms.com.
            (f) U S Spec MP Grout by U S Mix Products Co www.usspec.com.
            (g) CG-86 Grout by W R Meadows, Hampshire, IL www.wrmeadows.com.
            (h) Equal as approved by Architect before use. See Section 01 6000.
    c. Accessible Parking Signs:

1) Design Criteria:
   (a) Meet regulatory agency requirements for accessibility.
   (b) Sign graphics and lettering shall be minimum required by agency having jurisdiction:
      (1) International symbol of accessibility should be posted on all accessible parking spaces.
      (2) Letters must contain visual characters and high dark to light contrast between characters and background as per ADA requirements:
      (3) Provide reflective background.
      (4) Van-accessible parking spaces to have additional ‘text’ or ‘sign’ below the accessibility symbol to mark the van-accessible area specifically:
   (c) Size: 12 inches (305 mm) x 18 inches (457 mm) aluminum sign.
   (d) Sign shall have rounded corners.
2) Acceptable Products:
   (a) Parking signs by My Parking Sign, Brooklyn, NY www.MyParkingSign.com.
   (b) Equal as approved by Architect before use. See Section 01 6000.

d. Posts:
1) Handicap Accessible Parking Signage:
   (a) Provide galvanized post as shown on Contract Drawings.

e. Mounting Sleeves: Nominal 2-1/4 inch 56 mm outside diameter pipe, or 2-1/4 inch (57 mm) square 12 ga Quik-Punch, 30 inches (762 mm) long.

2. Installation:
a. Permanently Mounted:
1) Locate as shown on Site Plan.
   (a) Follow ADA guidelines and local and state authorities having jurisdiction (AHJ) for placement of sign requirements:
      (1) Van accessible sign should be placed so that it is not obscured by anything including a standing van, vehicle or other obtrusive objects.
      (2) Signs should be placed at such a height (at least 60 inches (1 500 mm) above surface) that they do not get obscured by any parked vehicles or other obstructions. Signs must be viewable from drivers' seat of vehicle and located right in view of parking spaces.
2) Install signs square and plumb.
3) Post Foundations:
   (a) Follow requirements of Section 03 3000: 'Miscellaneous Exterior Cast-In-Place Concrete' for post foundation:
      (1) Mix concrete components thoroughly, place in post foundation holes sized as shown on Contract Drawings.
   (b) Mow Strips:
      (1) At mow strips where shown on Site Plan, set top of post foundation below grade sufficient to allow for placing of mow strip.
   (c) Placement Before Installation of Slabs:
      (1) Measure post foundation depth from top of slab. Extend bottom of slab footing sufficient to allow specified amount of concrete around post.
   (d) Placement After Installation of Slabs:
      (1) Where posts are installed after installation of slabs, core slab width of foundation diameter as shown on Contract Documents to accommodate post foundation.

4) Handicap Accessible Parking Signage:
(a) Attach sign to galvanized steel posts as shown on Contract Drawings with stainless steel self tapping screws.
(b) Isolate dissimilar materials (steel tube and aluminum sign).
(c) For installation on retaining walls, cast sleeves into retaining wall. Sleeves shall extend 2 inches (50 mm) maximum above top of finish concrete elevation.

C. Owner Furnished Miscellaneous Interior Signage.
1. Approved Distributors. See Section 01 6000:
a. Standard Interior Signs:
1) Visual Identity Office:
(a) Contact Information:
(b) 50 E. North Temple St. Rm. 2350, Salt Lake City, UT 84150-3232.
(c) Phone: 1-801-240-1302.
(d) Fax: 1-801-240-5997.
(e) vidoffice@churchofjesuschrist.org.
2) Room Signs: Molded clear acrylic sub-surface graphics sign with set-screw to attach to included mounting bracket.
3) Provide tactile / braille features in signage.
4) Cabinet Door Signs: Flat clear acrylic sub-surface graphics sign with mounting adhesive in position.
5) Color:
(a) Background: Blue.
(b) Lettering: White.
2. Install interior signs square and plumb:
a. Room Signs:
1) Install bracket using two screws. Use proper anchor for substrate.
2) Attach sign to bracket using set-screw.
3) Mount signs as described in Contract Drawings.
b. Cabinet Signs:
1) Remove adhesive protective layer.
2) Position sign correctly and apply to door.
3) Roll sign to secure to door, taking care not to damage sign.
4) Mount signs as described in Contract Drawings.

D. Rest Room Doors Signs:
1. One sign for each designated Rest Room door indicating gender of users.
2. Quality Standard. See Section 01 6200.
a. No. 231595 California Title 24 signs by Best Sign Systems Inc, Montrose, CO www.bestsigns.com.

## 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. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

**END OF SECTION 10 1400**

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## SECTION 10 2113.13
## METAL TOILET COMPARTMENTS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Metal toilet compartments.

### 1.02 REFERENCE STANDARDS

A. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings 2022.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

### 1.04 SUBMITTALS

A. Product Data: Provide data on panel construction, hardware, accessories, and color selection.

B. Manufacturer's Installation Instructions: Indicate special procedures.

C. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Final, executed copy of Warranty.
      b. Record Documentation:
         1) Manufacturers documentation:
            (a) Manufacturer's literature or cut sheet.
            (b) Color selection.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage and Handling Requirements:
   1. Store and handle in compliance with Manufacturer’s instructions and recommendations

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Metal Toilet Compartments:
   1. Accurate Partitions Inc, Lyons, IL www.accuratepartitions.com.
   2. AMPCO Products Inc, Miami, FL www.ampco.com.
   3. Columbia Partitions, Columbia, SC www.psisc.com.
   4. Flush-Metal Partition Corp, Maspeth, NY www.flushmetal.com.
   5. Global Steel Products Corp, Eastanollee, GA www.globalpartitions.com.
   6. Hadrian Inc, Mentor, OH www.hadrian-inc.com.
   7. Knickerbocker Partitions Corp, Freeport, NY www.knickerbockerpartition.com.
   8. Metpar, Westbury, NY www.metpar.com.

### 2.02 COMPONENTS

A. Toilet and Miscellaneous Partitions:
   1. Floor-mounted, overhead-braced.

2. Panels:
    a. Galvanized bonderized steel sheets (minimum 0.00015 inch (0.004 mm) zinc coating).
    b. Edges bound interlocked with drawn molding welded on corners.
    c. Corners welded and ground smooth.
    d. Sound deadening honeycomb core.
    e. Provide wood blocking on all panels that have grab bars.
    f. Gauge:
        1) Doors: 22 ga (0.08 mm) minimum.
        2) Panels: 22 ga (0.08 mm) minimum.
        3) Pilasters: 22 ga (0.08 mm) minimum.
        4) Screens: 22 ga (0.08 mm) minimum.
3. Posts:
    a. 20 ga (one mm) minimum of same construction and finish as panels.
4. Headrails:
    a. Aluminum.
    b. 20 ga (one mm) minimum of same construction and finish as panels.
    c. Anti-grip design.
5. Plinths:
    a. 20 ga (one mm) Type 304 stainless steel, Number 4 finish.
    b. 3 inch (76 mm) minimum high, secured with concealed clips.
    c. All fasteners used to attach Plinths, Posts and Pilasters to the floor shall be Type 304 stainless steel.
6. Anchorages and fasteners:
    a. Concealed: Non-corrosive, protective finish.
    b. Tamper resistant Torx Head with pin screws.
7. Hardware:
    a. Each door:
        1) Gravity type hinges with double handed, nylon bottom cam, adjustable for partial door closing position, bottom hinge finished flush with door bottom.
        2) Sliding or concealed door bolt with emergency access.
        3) Door strike and keeper with rubber bumper.
        4) Coat hook / door bumper.
    b. Finish: Chrome plated.
    c. Meet requirements of ASTM B86, Alloy AG 40A.

B. Urinal Partition:
1. Basic construction same as panels above, floor and ceiling mounted.
2. Width to be 16 inches (400 mm) minimum.
    a. Partition maximum width shall not encroach into required accessibility clear floor space.

**2.03 FINISHING**

A. Finish and Color:
1. Powder-coated paint finish.
2. Color Quality Standards. See Section 01 6000. (Select color to coordinate with floor and wall tile selection.)

a. Accurate:
    1) 836 Sand
    2) 917 Adobe
    3) 920 Almond
    4) 965 Antique White
    5) 985 White
    6) 990 Light Gray
b. Ampco:
    1) White
    2) Yoke White
    3) Concrete
    4) Folkstone
    5) Porcelain
c. Global:
    1) Almond 2103
    2) Khaki 2115
    3) White 2129
d. Flush-Metal:
    1) 21 Dove Grey
    2) 25 Oyster White
    3) 35 Beige
    4) 61 White
    5) 70 Vanilla
e. Hadrian:
    1) Almond 603 or Latte 532
    2) White 500
    3) Linen 504
    4) Extra White 541
f. Knickerbocker:
    1) Almond 1111 or Sand 5123
    2) White
g. Metpar:
    1) Almond 300
    2) White 149
    3) Platinum 715

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that field measurements are as indicated.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

E. Field verify dimensions.

F. Verify that necessary blocking has been installed in framed walls for partition installation and for place where coat hook / door bumper will strike wall.

## 3.02 INSTALLATION

A. Install pilasters rigid, plumb, and level. Maintain proper door openings. Anchor pilaster to floor with Type 304 stainless steel fasteners embedded 2 inches (50 mm) into concrete slab below setting bed.

B. Secure panels to walls with two stirrup brackets minimum attached near top and bottom of each panel. Use fasteners of length to provide one-inch (25 mm) embedment into blocking or masonry.

C. Secure overhead brace to face sheets with two fasteners minimum per face. Set door tops parallel with brace. Set door bottom 12 inches (300 mm) above floor.

D. Plinth to be level with and snug to floor.

## 3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

## 3.04 FIELD QUALITY CONTROL

A. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:

1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.
2. Replace damaged or severely scratched materials with new materials at no additional cost to the Owner.

## 3.05 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

## 3.06 CLEANING

A. Remove protective masking. Clean exposed surfaces of partitions, hardware, fittings, and accessories.

B. Touch-up minor scratches and other finish imperfections using materials and methods recommended by Manufacturer.

**END OF SECTION 10 2113.13**

## SECTION 10 2233
## ACCORDION FOLDING PARTITIONS

# PART 1 GENERAL

### 1.01 SUMMARY OF WORK

A. Division 0 and Division 1, as indexed, apply to this section.

B. Furnish and install all manual accordion folding partitions shown on the drawings and specified herein.

### 1.02 RELATED REQUIREMENTS

A. Division 03 Sections - concrete tolerances required.

B. Division 05 Sections - primary structural support, including pre-punching of support members by structural steel supplier per partition supplier's template.

C. Section 06 1000 - Rough Carpentry: Wood blocking and shimming for track support.

D. Section 06 2000 - Finish Carpentry: Wood perimeter trim.

E. Section 07 2100 - Thermal insulation.

F. Division 09 - wall and ceiling trim finish at head and jambs.

G. Division 27 - Communications: Site wiring and connections for control, integration with AV controls for adjacent rooms.

### 1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

D. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings; 2020.

E. ASTM E413 - Classification for Rating Sound Insulation; 2022.

F. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).

G. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures; 2022.

H. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

I. ISO 14021 - Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling); 2nd Edition, 2020.

J. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.

K. ISO 14040 - Environmental Management - Life Cycle Assessment - Principles and Framework; 2006, with Amendment (2020).

L. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines; 2006, with Amendment (2020).

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate efforts of various trades affected by the Work of this Section.
      a. Ensure accurate installation of required headers, jambs and pocket framing.
   2. Coordinate completion of all associated trim.

B. Sequencing:
   1. Install folding partitions after following has been completed:
      a. Folding partition headers and adjacent walls and ceilings are finished and painted.
      b. All jambs and trim installed and finished.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on door operation, hardware and accessories, colors and finishes available.

C. Shop Drawings: Indicate opening sizes, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, and stacking sizes.

D. Samples: Submit two samples of surface finish, 5 by 5 inches size, illustrating quality.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and installation sequence.

F. Test And Evaluation Reports:
   1. Submit certified test reports evidencing compliance to acoustical STC (Rw) requirements as specified and in accordance to the references specified in this Section.

G. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Manufacturer's maintenance instructions:
            (a) Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
            (b) Seals, hardware, track, carriers, and other operating components.
      b. Warranty Documentation:
         1) Include copy of final, executed warranty / Certificate stating that installed materials comply with specification.
      c. Record Documentation:
         1) Manufacturers Documentation:
            (a) Manufacturer's literature.
            (b) Color selections.

H. Manufacturer's Certificate: Certify that door meets or exceeds specified acoustic requirements.

I. Maintenance Data: Describe cleaning materials detrimental to vinyl fabric surfaces and hardware finish. Include recommended cleaning methods, cleaning materials, and stain removal methods.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the folding partition manufacturer, as qualified to install the manufacturer’s partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Accordion Folding Partitions.

C. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified.

### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and partitions with numbering systems used on Shop Drawings. Do not use permanent markings on partitions.

B. Protect partitions during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

### 1.08 WARRANTY

A. Provide written warranty by manufacturer of partitions agreeing to repair or replace any components with manufacturing defects for a warranty period of 2 years from the date of substantial completion.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Accordion Folding Partitions (Horizontal Opening) Manufacturer:
   a. Won-Door Corporation, 1865 South 3480 West, Salt Lake City, Utah 84104
   b. Website: www.wondoor.com
   c. Contact Mark Green at 801-708-6582, Email: magreen@wondoor.com

### 2.02 ACCORDION FOLDING PARTITIONS – (CLASSROOMS)

A. Approved Product for classrooms
   1. DuraSound Accordion Folding Partition

B. Components
   1. Manually operated.
   2. Top supported.
   3. Accordion folding.

C. Construction
   a. Shall consist of two parallel accordion-type walls of panels independently suspended with no pantographs or interconnections except at the leadpost. Panels shall be formed of cold rolled vinyl-clad 24-gauge V-grooved steel. Vinyl shall be permanently bonded by heat pressure lamination to the steel panel. Panels shall be connected by full height extruded vinyl hinges. Lead-posts shall be of 1/8" thick extruded aluminum and shall be connected to the partition by specially formed attachment wings.
   2. Sound Transmission Class:
      a. Laboratory acoustical performance of the folding partition shall have been tested in an independent acoustical laboratory, in accordance with ASTM E90 test procedure, classified in accordance with ASTM E413 and shall have attained an STC rating of no less than: 48 STC and a minimum of 30 NIC at installation

D. Hardware:
   1. Grip type hand pulls shall be die cast zinc, powder coated black finish with a sliding latch to secure closure. Extruded aluminum or plastic hand pulls will not be accepted.

E. Sound Seals

1. Shall consist of perimeter seals of continuous extruded vinyl sweep strips attached to the top and bottom of the partition. Leading edges of lead-posts and receiver posts shall be acoustically sealed by interlocking extruded vinyl seals.
2. Sound Insulation: Interior surfaces of both walls of panels shall be completely covered with a continuous blanket of 2 lb. density foil-backed fiberglass fastened in place with steel spring-clips.

F. Suspension System
1. Classrooms: Suspension System with aluminum ceiling saver track and trolley sizes matched to the size of the partition.
2. Suspension Tracks: Two parallel aluminum extruded continuous "C" channel shaped track spaced 6” o.c., connected to the wood header. (12” wood header required).
a. Carriers: Each panel shall be suspended by a steel hanger and a nylon-tired ball bearing roller. Each leadpost shall be suspended from the suspension track by a 12 wheel ball bearing roller trolley assembly.

## 2.03 ACCORDION FOLDING PARTITIONS - (CHAPEL, CULTURAL HALL AND PLATFORM)

A. Approved Product for Chapel, Cultural Hall and Platform
1. DuraSound Accordion Folding Partition

B. Components
1. Manually operated.
2. Top supported.
3. Accordion folding.

C. Construction
a. Shall consist of two parallel accordion-type walls of panels independently suspended with no pantographs or interconnections except at the leadpost. Panels shall be formed of cold rolled vinyl-clad 24-gauge V-grooved steel. Vinyl shall be permanently bonded by heat pressure lamination to the steel panel. Panels shall be connected by full height extruded vinyl hinges. Lead-posts shall be of 1/8” thick extruded aluminum and shall be connected to the partition by specially formed attachment wings.
2. Sound Transmission Class:
a. Laboratory acoustical performance of the folding partition shall have been tested in an independent acoustical laboratory, in accordance with ASTM E90 test procedure, classified in accordance with ASTM E413 and shall have attained an STC rating of no less than: 48 STC and a minimum of 30 NIC at installation.

D. Hardware:
1. Grip type hand pulls shall be die cast zinc, powder coated black finish with a sliding latch to secure closure. Extruded aluminum or plastic hand pulls will not be accepted.

E. Sound Seals
1. Shall consist of perimeter seals of continuous extruded vinyl sweep strips attached to the top and bottom of the partition. Leading edges of lead-posts and receiver posts shall be acoustically sealed by interlocking extruded vinyl seals.
2. Sound Insulation: Interior surfaces of both walls of panels shall be completely covered with a continuous blanket of 2 lb. density foil-backed fiberglass fastened in place with steel spring-clips.

F. Suspension System
1. Suspension System with aluminum track and trolley guide with trolley sizes matched to the size of the partition.

2. Stabilizer bar trolley (Required on all partitions exceeding 12’-0” in height) shall consist of a top supported, internally mounted diagonal brace connected to the lead-post for proper alignment during operation and latching. Requires a 14” wide wood header min.
3. Suspension Tracks: Two parallel aluminum extruded continuous "C" channel shaped track, connected to the structural support.
    a. Carriers: Each panel shall be suspended by a steel hanger and a nylon-tired ball bearing roller. Each leadpost shall be suspended from the suspension track by a 16 wheel ball bearing roller trolley assembly.

### 2.04 FINISH MATERIALS

A. Accordion Folding Partitions:
1. 24 gauge roll formed steel panels with vinyl finish permanently bonded by heat pressure lamination.
    a. Color: White (ML-885) or Sandalwood (PN-163)
    b. Vinyl hinge to match panel color
    c. Hardware fasteners to match panel color
    d. Perimeter trim to be black vinyl

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of partitions. Proceed with installation only after unsatisfactory conditions have been corrected. Headers shall be parallel with the finished floor to within +/- ¼” tolerance over the entire opening.

### 3.02 INSTALLATION (FOR REMODELS, VERIFY STRUCTURAL CAPACITY)

A. Install door in accordance with manufacturer's instructions.

B. Fit and align partition assembly level and plumb.

C. Install so track system is aligned, level, etc, to eliminate catching or binding of rollers.

D. Install partitions and accessories after other finishing operations, including painting have been completed.

E. Install tie-backs at all accordion folding partitions. Adjust as necessary to keep accordion folding partition in stacked position.

### 3.03 ADJUSTING

A. Adjust partitions to operate smoothly, easily, and quietly throughout entire operational range. Lubricate hardware and other moving parts.

B. Visually inspect partition in fully closed position for light leaks to identify a potential acoustical leak and adjust to achieve light tight seal.

### 3.04 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer’s written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

### 3.05 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation and maintenance procedures to Owner’s representative.

B. Provide Operation and Maintenance Manual to Owner's representative.

**END OF SECTION 10 2233**

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**SECTION 10 2239**
**FOLDING PANEL PARTITIONS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Automatic vertically retractable acoustic walls as shown on the Contract Drawings.

B. All necessary hardware, seals, lifting machinery, and electrical controls.

C. Top-supported operable panel partitions, vertical opening, electrical operation.

### 1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Steel structure supporting the Automatic Retractable Acoustical Wall.

B. Section 09 2116 - Gypsum Board Assemblies: Storage pockets along the axis of the Automatic Retractable Acoustical Wall.

C. Section 06 1000 - Rough Carpentry: Wood blocking and track support shimming.

D. Section 07 2100 - Thermal Insulation: Insulation above, below, and in the fixed walls at both ends of the Automatic Retractable Acoustical Wall.

E. Division 26 - Electrical: Site wiring and connections for main power, including disconnect switches at each motor location.

F. Division 27 - Communications: Site wiring and connections for control, integration with AV controls for adjacent rooms, and installation of touch screen control devices as specified in this Section.

### 1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2022.

B. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings 2020.

C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

D. ASTM E413 - Classification for Rating Sound Insulation 2022.

E. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions 2012 (Reapproved 2020).

F. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures 2022.

G. ISO 354 - Acoustics Measurement of sound absorption in a reverberation room 2nd Edition, May 15, 2003.

H. ISO 10140-5 - Acoustics — Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipment 2nd Edition, April 2021.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate efforts of various trades affected by the Work of this Section.
      a. Ensure accurate installation of required headers, jambs and pocket framing.
   2. Coordinate completion of all associated trim.
   3. Coordinate completion of operable wall installation with sound system testing so acoustic testing of operable walls may be performed at same time.

B. Sequencing:
   1. Install operable walls after following has been completed:
      a. Headers and adjacent walls and ceilings are finished and painted.

b. All jambs and trim installed and finished.
c. Floor threshold has been installed.
d. Athletic wood flooring has been installed and properly cured which is usually thirty (30) days.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

C. Provide data on Operable Wall operation, hardware and accessories, colors and finishes available.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Shop Drawings:
1. Show complete layout of operable wall system based on field verified dimensions. The drawings shall include dimensional relationship to adjoining work. Include details indicating materials, finishes, tolerances, and methods of attachment to building steel and electrical requirements.

F. Test And Evaluation Reports:
1. Submit certified test reports evidencing compliance to acoustical STC (Rw) requirements as specified and in accordance to the references specified in this Section.

G. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Operations and Maintenance Data:
      1) Manufacturer's maintenance instructions:
         (a) Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
         (b) Seals, hardware, track, carriers, and other operating components.
   b. Warranty Documentation:
      1) Include copy of final, executed warranty / Certificate stating that installed materials comply with specification.
   c. Record Documentation:
      1) Manufacturers Documentation:
         (a) Manufacturer's literature.
         (b) Color selections.

H. Maintenance Data:
1. Describe cleaning materials detrimental to vinyl fabric surfaces and hardware finish. Include recommended cleaning methods, cleaning materials, and stain removal methods.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer’s partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.

C. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver in Manufacturer's original, unopened package(s).

B. Store products in manufacturer's unopened packaging until installation.

C. Provide secure location protected from the weather and other trades.

## 1.08 WARRANTY

A. Basic Warranty: The operable wall shall be warranted free from defects in material and workmanship for a period of two (2) years or five thousand (5,000) cycles, whichever occurs first, from the date of shipment. Extended Parts Warranty (optional): An extended warranty on parts (excluding touch screen operator stations) is available in addition to the basic warranty. It includes coverage on all parts for a period of ten (10) years or five thousand (5,000) cycles, whichever occurs first from date of shipment. Refer to Owner's manual for full warranty details.

B. Acoustical Performance: The operable wall shall retain its acoustical properties for 10 years from the date of shipment providing proper maintenance has been performed on the operable wall.

C. Parts and labor required to maintain the operable wall and part subject to normal wear and tear are not covered under the warranty and are the owner's responsibility. (Refer to Maintenance Program).

# PART 2 PRODUCTS

## 2.01 MANUFACTURERS

A. Operable Panel Partitions - Vertical Opening:
   1. Skyfold Inc. Baie d'Urfe (Montréal) Québec, Canada Web-site: www.skyfold.com
      a. Contact Joel Brinkle at 480-263-3561 or joel.brinkle@modernfold.com

## 2.02 OPERABLE PANEL PARTITIONS - VERTICAL OPENING

A. Approved Product between chapel and cultural hall. See Section 01 6000:
   1. Skyfold Zenith® 48:
      a. System STC 48 (Rw 47), Panel Construction STC 57 (Rw 56)

B. Sound Transmission Requirements:
   1. Automatic vertically retractable acoustic wall tested for laboratory sound transmission loss performance according to ASTM E90, determined by ASTM E413 and rated for an STC as follows:
      a. Sound transmission class (STC):
         1) Construction: 57 STC
         2) Fully automatic operable wall: 48 STC minimum.

C. Description:
   1. Definition
      a. Automatic Vertically Retractable Acoustical Wall (Operable Wall) shall refer specifically to acoustical partitions that, when in the down position (closed) are hard, rigid, flat, plumb walls, made of a grid of rectangular acoustical panels, and when are lifted (opened), fold upward (vertically) without the use of any manual labor, in a manner similar to an accordion, into a framed pocket in the ceiling. In the down (closed) position, the operable wall shall be comprised of two vertical planes of acoustical panels, separated by an acoustical air space.
   2. Controls:
      a. Operation controls by two touch screen operator stations.
      b. Both touch screens must be operated at the same time for operable wall to open or close.
   3. Operation:
      a. The operable wall shall open and close in a manner similar to an accordion, in that all wall panels fold and unfold sequentially in an accordion fashion.
      b. From a fully open position, the operable wall shall be able to go through its entire cycle of closing and/or opening without any manual intervention.
      c. When the operable wall is being lowered (closed) it shall come automatically to rest once it has reached the fully down (closed) position.
      d. When the operable wall is being lifted (opened) it shall come automatically to rest once it has reached the fully up (open) position.

e. The operable wall shall automatically and acoustically seal against the floor without the need for any manual intervention. The floor seals shall leave a joint between the floor and the bottom acoustical panels of not more than approximately 2”.
f. The operable wall shall automatically and acoustically seal against the two end walls without the need for any manual intervention. The end seals shall act in such a way as not to come into contact with the end walls while the operable wall is in motion. The end seals shall leave a joint between the acoustical panels and the end walls of no more than approximately 1” (25 mm). Seals that rub or brush against the end walls are not acceptable. Once the operable wall reaches the full down position, the end seals shall activate automatically.
    1) The control stations do not need to be activated during the deployment of the end seals.
g. The operable wall shall automatically and acoustically seal against the ceiling without any manual intervention. The top seals shall leave a joint between the top acoustical panels and the ceiling of the pocket of not more than approximately 2”.
h. The operable wall shall open and close at an average speed of approximately 5 to 10 vertical feet per minute.
i. When the operable wall is being lowered (closed), it shall stop if the leading (bottom) edge comes into firm contact with any object between it and the floor. The operable wall will then automatically reverse its direction and ascend for approximately 3 seconds to clear the object. The regular operation of the operable wall can resume once the obstruction has been removed.

4. Standard Drive System:
    a. Motor drive assembly is mounted directly above the center line of the operable wall.
    b. Support steel required where shown on the Contract Drawings.

D. Materials:
1. Panels:
    a. Steel-faced panels coated with scratch resistant, permanently bonded decorative vinyl finish.
    b. Modular construction.
    c. Constructed of non-combustible or fire-treated materials.
    d. Panel finish:
        1) Maximum weight of material: 0.111 lbs/ft²
        2) Maximum thickness of material: 1/8”
        3) Finishes shall be railroaded onto the panels, applied horizontally along the panel length.
        4) Color and Pattern Finish: SKY-402
    e. Panels shall be visibly flat and rigid in the down (closed) position.
    f. There shall be no exposed hinges, brackets, screws, and no part of the mechanical system shall be visible when the operable wall is in the down (closed) position.
    g. All of the panel edges shall be right angled, with a minimum radius not more than 1/16”.
    h. All of the panels shall be rectangular, nominally of the same size.
    i. Joints between panel, vertical and horizontal, shall be no more than approximately ½”.
    j. The operable wall shall stack in the up (open) position into a space no greater than 65” wide. The operable wall shall have a stacking height ratio in the range of 1:5 to 1:10, depending on the height of the wall.
    k. Each acoustical panel shall be individually removable using only a screwdriver. No special tools or equipment shall be required. The removal of a single acoustical panel shall not affect, dislocate or cause the removal of any adjacent panels or other acoustical panels.
2. Folding Mechanism

a. The hanging, folding and extension mechanism shall be made from structural grade aluminum extrusions and structural shapes.
b. All wear surfaces, such as bushings, spacers, pins, discs, bearings, and sleeves shall be designed to function quietly and with minimum wear over the design life cycle of the operable wall.
c. Wherever possible, ball bearings shall be used instead of bushings and wear surfaces.
d. Chain or belt drive systems shall not be used.
e. The hangers, which fasten the lifting mechanism to the support steel, shall be fabricated from steel and shall be welded or bolted to the support steel supplied by others.

3. Motor Drive and System:
   a. Sized to operate the operable wall effectively over the design life cycle of the wall, at the minimum design speed specified.
   b. Designed to use the latest in industry standards in thermal protection, overload protection, quick acting fuses, etc., in order to ensure the safety and reliability of the system.
   c. Cable:
      1) Include a wire rope cable for every set of folding mechanism.
      2) 6 x 31 construction aircraft-grade galvanized steel cable.
      3) Diameter sized to support the entire weight of the operable wall, with the appropriate safety factor.
      4) Wraps on yoyo drums with 2 safety wraps and multiple layers of cable.
   d. Line shaft:
      1) Supports and rotates the cable drums.
      2) Sized to deliver the required torque with minimum deflection.
   e. Flange bearings shall be used for the drive system, located immediately on both sides of the drum assembly.
4. Safety Equipment:
   a. Electromagnetic brake:
      1) Activates immediately at loss of power to the system.
      2) Minimum retarding torque rating equal to 200% of the motor drive’s full load torque.
      3) Include manual override for the drive and a brake release lever.
   b. Dynamic brake:
      1) Activates at catastrophic failure in the motor drive's power train.
      2) Halts operation of the operable wall, or controls the speed at 150% of the normal down speed.
   c. Limit switches:
      1) Set the up and down travel limits of the operable wall.
   d. Over-torque detector:
      1) Mechanical sensor using the drive motor's torque arm.
      2) Activates at a jam in the system.
      3) Operates as an over-travel limit in the up direction at failure of the upper limit switch.
   e. Pressure sensing strip:
      1) Continuous along the bottom edge of the operable wall.
      2) Cuts power to the motor drive and activates the electromagnetic brake.
      3) Activates if the sensing edge comes in firm contact with an object prior to obtaining the full down (closed) position.
      4) Triggers reverse direction operation to lift the wall for 3 seconds to allow obstruction objects to be cleared.
      5) Power shall remain cut to the motor drive until the pressure sensing switch has been released.

E. Performance:
   1. Design Criteria:
      a. General:
         1) Total operable wall assembly shall be repairable at installed location without removal to repair shop or factory.
         2) The operable wall shall not weigh more than the following (excluding the motor drive and architectural finish): ~6.0 lbs per ft²
      b. Life Cycle:
         1) At least 10,000 complete closed to opened to closed cycles.
   2. Panels:
      a. Acoustical panels shall be architecturally flat with no bowing, oil canning, warping, waviness or any other surface deformation and discontinuity.

**2.03 ACCESSORIES**

A. Electrical Control Box: NEMA 1.

B. Touch Screen Operator Stations:
   1. Two 4.3” resistive LCD touch screens, wired in series with multilingual capabilities and 4-digit adjustable user pin.
   2. AV dry contacts, linked to the building AV system to control the speakers between the Chapel and Cultural Center as noted in the Contract Drawings and Specifications.
   3. Low-voltage Wiring: 18 gauge wiring from the operator stations to the control box (Furnished and installed by the Contractor).

**2.04 FABRICATION**

A. Factory assemble all components, assemblies and systems into the largest possible assemblies in order to minimize the amount of assembly on site.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that field measurements are as indicated.

B. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

C. Verify track supports are laterally braced and will permit track to be level within the manufacturer tolerances of required position and parallel to the floor surface over entire length of the opening.

D. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.

E. Verify wall plumbness of 1/8 inch in 10 feet, non-cumulative.

F. Verify conditions are in accordance with approved shop drawings.

G. Notify Architect in writing of unsatisfactory conditions or non-compliance:
   1. Do not install in unsatisfactory openings.

H. Commencement of Work by installer is considered acceptance of substrate.

**3.02 INSTALLATION (FOR REMODELS, VERIFY STRUCTURAL CAPACITY)**

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Install electric operator, wiring, and controls. Locate control station(s) as indicated.

C. Fit and align partition assembly and pocket doors level and plumb.

D. Lubricate moving components.

E. Install acoustic sealant to achieve required acoustic performance.

F. Coordinate electrical connections.

G. Special Techniques:

1. Installation shall comply with requirements of ASTM E557.

## 3.03 FIELD QUALITY CONTROL

A. Field Tests:
   1. Installer shall test completed assembly using own sound source and instruments:
      a. Make corrections required to meet specified NIC rating.
      b. When completed, notify Architect and Door Manufacturer in writing that partition is ready for testing by Architect's Sound / Acoustic Consultant.
   2. Architect's Sound / Acoustic Consultant will test finished, installed folding panel partition assemblies to determine NIC ratings specified above:
      a. Notify Door Manufacturer minimum forty-eight (48) hours in writing prior to test time, verifying specific date in writing.
   3. Testing will occur at time of sound system balancing.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Sound / Acoustic testing:
      a. If partitions do not meet specified NIC requirements or if partitions are not ready for testing, make necessary corrections and pay for additional fees and expenses required for subsequent testing.
   2. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

## 3.04 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

D. CLEANING

E. Clean finish surfaces and partition accessories.

F. General:
   1. Clean any soiling of partitions as recommended by Manufacturer or any surrounding areas caused by installation of partitions.

G. Building Damage:
   1. Installer responsible for cleaning and repair of all damaged surfaces to their original condition from partition installation.

H. Waste Management:
   1. All work areas are to be kept clean, clear and free of debris at all times.
   2. Disposal of rubbish, debris, and packaging materials to Dumpster.

## 3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

B. Demonstration:
   1. After installation and when folding panel partition is fully operational, provide minimum two (2) hour instruction and demonstration period concerning operation and maintenance of folding panel partitions.
   2. Those to be included in instruction period are Architect, Owner's Representative, Seminary Principal / Institute Director, and Facilities Manager.

C. Instruction of Owner:
   1. After installation, meet with Owner’s Representative’s personnel.
      a. Review maintenance procedures and materials using specified maintenance and repair Manual.

### 3.06 PROTECTION

A. Upon completion of partition installation, protect partitions from damage and replace or repair subsequent damage at no cost to Owner.

**END OF SECTION 10 2239**

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## SECTION 10 2600
## WALL AND DOOR PROTECTION

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Corner guards.

### 1.02 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

D. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls 2019.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A. Product Data: Manufacturer's literature, Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements, color selections.

B. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two sections of corner guards, 12 inches long.

D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Maintenance Data: For each type of product include information regarding recommended and potentially detrimental cleaning materials and methods.

F. Test and Evaluation Reports:
   1. Copies of Quality Assurance requirements for ‘Class A’ flame spread rating.

G. Qualification Statement:
   1. Installer:
      a. Provide Qualification documentation if requested by Architect or Owner.

H. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance, and cleaning instructions.
      b. Warranty Documentation:
         1) Final, executed copy of Warranty

c. Record Documentation:
1) Manufacturers documentation:
(a) Manufacturer's literature.
(b) Color selection.

### 1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
1. System shall be recognized for intended use by applicable building codes.

B. Qualifications:
1. Installers:
a. Installer shall have performed at least three (3) installations of similar size, scope, and complexity in each of the past two (2) years.
b. Provide documentation if requested.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged, unopened protective packaging. Intact Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

F. Storage and Handling Requirements:
1. Store materials in protected area in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to elements. Minimum room temperature of 40 deg F (4.4 deg C) and a maximum of 100 deg F (37.8 deg C) should be maintained.

G. Ambient Conditions:
1. Material must be acclimated in an environment of 65 deg F to 75 deg F (18 deg C to 24 deg C) for at least twenty-four (24) hours prior to beginning installation.
2. Installation areas must be enclosed and weatherproofed before installation commences.

## PART 2 PRODUCTS

### 2.01 PRODUCT TYPES

A. Corner Guards:
1. Manufacturers:
a. Stainless Steel Corner Guards:
1) Acceptable Manufacturers:
(a) Acrovyn, Div Construction Specialties Group, Muncy, PA www.c-sgroup.com.
(b) American Floor Products Co, Rockville, MD www.afco-usa.com.
(c) IPC Door and Wall Protection Systems, Muskego, WI www.inprocorp.com.
(d) Pawling Corp, Pawling, NY www.pawling.com.
(e) Equal as approved by Architect before installation. See Section 01 6000 .
b. Vinyl Corner Guards:

1) Approved Manufacturers.
   (a) Acrovyn, Div Construction Specialties Group, Muncie, PA www.c-sgroup.com.
   (b) American Floor Products Co, Rockville, MD www.afco-usa.com.
   (c) IPC Door and Wall Protection Systems, Muskego, WI www.inprocorp.com.
   (d) Koroseal Wall Protection Systems, Fairlawn, OH www.korogard.com.
   (e) Pawling Corp, Pawling, NY www.pawling.com.

2. Materials:
   a. Stainless Steel Corner Guards:
      1) 16-ga (1.6 mm) stainless steel with finish equal to US32D Satin Stainless Steel.
      2) Size:
         (a) Wall Corners: 3-1/2 inches (89 mm) by 3-1/2 inches (89 mm) by 48 inches (1200 mm) high.
   b. Vinyl Corner Guards:
      1) Design Criteria:
         (a) Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.
      2) Color and Texture: As selected by Architect from Manufacturer's premium colors.
      3) Design Standard: Acrovyn VA Series, 1-1/2 inches (38mm) by 1-1/2 inches (38mm).
3. Fabrication:
   a. Fabricate wall protection systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located, and identify conditions detrimental to proper or timely completion.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.
   1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Notify Architect of unsuitable conditions in writing.

E. Do not proceed until unsatisfactory conditions have been corrected.

F. Start of installation constitutes acceptance of project conditions.

### 3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Apply adhesive carefully to insure continuous contact between wall and guard. Take care to avoid soiling or leaving visible adhesive on wall or base.

C. Maintain ambient conditions for at least forty-eight (48) hours.

D. Allow materials to acclimate to building temperature 65 to 75 deg F (18 to 24 deg C) for at least twenty-four (24) hours prior to installation.

E. Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

F. Surface Preparation:
   1. Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
   2. Follow Manufacturers' installation instructions, using only approved mounting hardware, and locating all components firmly into position, level and plumb.

**3.03 TOLERANCES**

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

**3.04 CLEANING**

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants as per Manufacturer's cleaning instructions.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

**3.05 PROTECTION**

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

**END OF SECTION**

## SECTION 10 2800
## TOILET, BATH, AND LAUNDRY ACCESSORIES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Utility room accessories.

### 1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM C1036 - Standard Specification for Flat Glass 2021.

F. ASTM F446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area 2019.

G. ISO 25537 - Glass in building — Silvered, flat-glass mirror 2008.

### 1.03 SUBMITTALS

A. Product Data: Submit data on accessories describing operating characteristics, size, finish, details of function, rough-in dimensions and attachment methods.

B. Shop Drawings:
   1. Schedule showing items used, location where installed, and proper attaching devices for substrate.

C. Manufacturer's Installation Instructions: Indicate operation, care, cleaning instructions, special procedures and conditions requiring special attention.

D. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   2. Operations and Maintenance Data:
      a. Folding Bench:
         1) Manufacturer’s service and parts manual.
   3. Warranty Documentation:
      a. Final, executed copy of Warranty for each product.
   4. Record Documentation:
      a. Manufacturers documentation:
         1) Manufacturer's literature or cut sheets.

### 1.04 QUALITY ASSURANCE

A. Source Limitations:
   1. For products listed together in same Part 2 articles, obtain products from single source from single manufacturer.

## 1.05 WARRANTY

A. Commercial Toilet Accessories:
   1. Manufacturer's standard warranty.

B. Baby Changing Station:
   1. Manufacturer's standard warranty to be free from defects in material and workmanship under normal use and service, with proper maintenance, for five (5) years.

C. Special Mirror Warranty:
   1. Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage or frame corrosion defects within specified warranty period:
      a. Warranty Period: fifteen (15) years from date of Substantial Completion.

# PART 2 PRODUCTS

## 2.01 OWNER-FURNISHED PRODUCTS

A. Approved Products:
   1. Automatic Touchless Towel Dispensers:
      a. Size: 14.8 inches (376 mm) wide x 9.75 inches (248 mm) deep x 16.75 inches (425 mm) high.
   2. Soap dispensers.
   3. Toilet tissue dispensers.

B. Baby Changing Station:
   1. Horizontal: Koala Kare model number KB200 by Koala.

## 2.02 MANUFACTURED UNITS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. AJW Architectural Products, A&J Washroom Accessories, Inc., New Windsor, NY www.ajwashroom.com.
      b. American Specialties Inc (ASI), Yonkers, NY www.americanspecialties.com.
      c. Bobrick Washroom Equipment Inc, North Hollywood, CA www.bobrick.com or Bobrick Washroom Equipment of Canada Ltd, Scarborough, ON (416) 298-1611.
      d. Bradley Corp, Menomonee Falls, WI www.bradleycorp.com.
      e. General Accessory Manufacturing Co (GAMCO), Durant, OK www.gamcousa.com.

B. Materials:
   1. Design Criteria:
      a. Stainless Steel: ASTM A666 Type 304 (18-8); satin finish exposed surfaces unless otherwise indicated.
      b. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
      c. Fasteners:
         1) Exposed: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant.
         2) Concealed: Galvanized Steel.
   2. Rest Rooms:
      a. Mirrors:

1) Channel-Frame Mirror:
   (a) Frame: Type 304 or Type 430, 20 gauge stainless steel channel frame.
   (b) Roll-formed one piece construction.
   (c) Exposed surfaces have #4 satin finish.
   (d) Edges and corners are burr free.
   (e) Glass: 1/4 inch (6.4 mm) silver coated and hermetically sealed. Guaranteed for 15 years against silver spoilage. Mirrors meet ASTM C1036 requirements.
   (f) Concealed surface mounted wall hanger.
2) Approved Products. See Section 01 6000:
   (a) AJW Architectural Products: Model U711.
   (b) American Specialties (ASI): Model 0620.
   (c) Bobrick: Model B-165.
   (d) Bradley: Model 781.
   (e) General Accessory (GAMCO): Model C Series.

b. Sanitary Napkin Disposal Container:
1) Design Criteria:
   (a) Surface mounted type 304, 22 gauge stainless steel with #4 satin finish. Seamless construction with radius and hemmed edges.
   (b) Stainless steel piano hinge.
2) Approved Products. See Section 01 6000:
   (a) AJW Architectural Products: Model U590.
   (b) American Specialties (ASI): Model 0852.
   (c) Bobrick: Model B-270.
   (d) Bradley: Model 4781-15.
   (e) General Accessory (GAMCO): Model ND-1.

c. Single Robe Hook:
1) Surface mounted type 304, 22 gauge stainless steel with #4 satin finish.
2) Concealed mounting bracket.
3) Stainless steel locking setscrew on bottom.
4) Approved Products. See Section 01 6000:
   (a) AJW Architectural Products: Model UX110SF.
   (b) American Specialties (ASI): Model 7340-S.
   (c) Bobrick: Model B6717.
   (d) Bradley: Model 9114.
   (e) General Accessory (GAMCO): Model 76717.

d. Grab Bars:
1) Configuration shown on Contract Drawings. Include center support for longer lengths when required:
2) Design Criteria:
   (a) Comply with ADA guidelines and ADAAG accessible design for structural strength and local and state codes.
   (b) Concealed mount.
   (c) 18 ga (1.27 mm), type 304 stainless steel tubing.

(d) 1-1/2 inch (38 mm) diameter.
(e) Provide center support when required.
(f) Snap-on flange covers.
(g) Peened (non-slip) finish.
(h) Sustain loads in excess of 900 lbs (408 kg).

3) Approved Products. See Section 01 6000:
(a) AJW Architectural Products: Model UG3 Series.
(b) American Specialties (ASI): Model 3800 Series.
(c) Bobrick: Model B-6806 Series.
(d) Bradley: Model 812 Series.
(e) General Accessory (GAMCO): Model 150 Series.

e. Shelf:
1) Design Criteria:
(a) 18 ga (1.27 mm), stainless steel with No. 4 Satin finish.
(b) 6 inches (150 mm) wide.

2) Approved Products. See Section 01 6000:
(a) AJW Architectural Products: Model U776.
(b) American Specialties (ASI): Model 0692.
(c) Bobrick: Model B-296.
(d) Bradley: Model 756.
(e) General Accessory (GAMCO): Model S-6.

3. Custodial Rooms:
a. Utility Shelf:
1) Provide mop / broom hangers, shelf, and rod for hanging rags.
2) Size as shown on Contract Drawings.
3) Approved Products. See Section 01 6000:
(a) AJW Architectural Products: Model UJ41.
(b) American Specialties (ASI): Model 1300 Series.
(c) Bobrick: Model B-224 Series.
(d) Bradley: Model 9933 Series.
(e) General Accessory (GAMCO): Model US Series.

4. Mother's Rooms:
a. Mirror:
1) Size:
(a) 24 inch by 60 inch (600 mm by 1 500 mm) mirror.

2) Channel-Frame Mirror:
(a) Frame: Type 304 or Type 430, 20 gauge stainless steel channel frame.
(b) Roll-formed one piece construction.
(c) Exposed surfaces have #4 satin finish.
(d) Edges and corners are burr free.
(e) Glass: 1/4 inch (6.4 mm) silver coated and hermetically sealed. Guaranteed for 15 years against silver spoilage. Mirrors meet ASTM C1036 requirements.
(f) Concealed surface mounted wall hanger.

3) Approved Products. See Section 01 6000:
   (a) AJW Architectural Products: Model U711.
   (b) American Specialties (ASI): Model 0620.
   (c) Bobrick: Model B-165.
   (d) Bradley: Model 781.
   (e) General Accessory (GAMCO): Model C Series.

5. Folding Bench:
   a. Design Criteria:
      1) Reversible solid phenolic folding shower seat.
      2) Frame constructed of type 304, satin-finish stainless steel.
      3) Comply with barrier-free ADA accessibility guidelines.
   b. Acceptable Product:
      1) Bobrick: Model B-5181.
      2) Equal as approved by Architect before installation. See Section 01 6000.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

E. See Section 06 1000 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

### 3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. 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.

C. Comply with ADA Accessibility Guidelines and installation heights as shown on Contract Drawings.

D. Assemble fixtures and associated fittings and trim in accordance with manufacturer's instructions.

E. Install using mounting devices proper for base structure.

F. Install equipment level, plumb, and firmly in place in accordance with manufacturer's rough-in drawings.

G. Where possible, mount like items in adjoining compartments back-to-back on same partition.

H. Folding Bench:
   1. Secure unit to wall as per Manufacturer instructions.

I. Grab Bars:
   1. Install as per Manufacturers written installation instructions.
   2. Install grab bars to withstand downward force of not less than 250 lbf (1112 N) per ASTM F446.

J. Baby Changing Stations:
   1. Verify that solid blocking has been installed in wall framing where changing station is to be installed.
   2. Do not install unit by any other means other than screws or lag bolts into solid blocking.

K. Install items in accordance with Manufacturer's submitted, written instructions for screws or lag bolts into solid substrate capable of supporting 200 lbs (90 kg). Install using mounting devices proper for base structure.

**3.04 REPAIR**

A. Repair or replace defective work, including damaged equipment and components.

B. Repair or replace malfunctioning equipment, or equipment with parts that bind or are misaligned.

**3.05 CLEANING**

A. Clean unit surfaces and leave in ready-to-use condition.

**3.06 ADJUSTING**

A. Test each piece of equipment provided with moving parts to assure proper operation, freedom of movement, and alignment. Install new batteries in battery-powered items.

**3.07 CLOSEOUT ACTIVITIES**

A. Turn over keys, tools, maintenance instructions, and maintenance stock to Owner.

**3.08 PROTECTION**

A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

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## SECTION 10 2815
## MISCELLANEOUS ACCESSORIES

### PART 1 GENERAL

### 1.01 SUMMARY

A. Products Furnished but Not Installed Under This Section:
   1. Wall-mounted coat racks and hangers as described in Contract Documents.
   2. Door-mounted coat racks and hangers.
   3. Wall clocks.

### 1.02 RELATED REQUIREMENTS:

A. Section 06 1000 - Rough Carpentry for wall blocking.

B. Section 06 2000 - Finish Carpentry for:
   1. Installation of Coat Racks.
   2. Furnishing and installation of Wardrobe Hooks (Coat and Hat Hooks).
   3. Furnishing and installation of Hooks (mounted in accessible stalls in Restrooms in projects with Baptismal Fonts).

C. United States Department of Justice Civil Rights Division (www.ADA.gov)
   1. The Americans with Disabilities Act of 1990:
      a. Guidance on the 2010 ADA Standards for Accessible Design.

### 1.03 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturers documentation:
            (a) Manufacturer's literature.

### PART 2 PRODUCTS

### 2.01 WALL-MOUNTED COAT RACKS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. EMCO Specialty Products Inc, Kansas City, KS www.emcospi.com.
      b. Magnuson Group, Burr Ridge, IL www.magnusongroup.com.

B. Materials:
   1. Coat Racks:
      a. Furnish one hanger for each 2-1/2 inches (63 mm) of rack.
      b. Design Criteria:
         1) Wall mounted.
         2) Brackets: powder-coated metal.
         3) Shelf Slats or Tubes: aluminum.
         4) Hanger Bar: 1 inch (25 mm) metal.
         5) Finish as selected by Architect.
      c. Acceptable Products:
         1) Coat Hall Alcoves:
            (a) EMCO System R1.

(b) Magnuson DS-3HA Series.

2) Coat Rooms:
   (a) EMCO System R1.
   (b) Magnuson DS-3HA Series.
3) Hangers / Receptacles:
   (a) EMCO No. 17 ball top hangers and model C receptacles.
   (b) Magnuson MIRAC MG-17PH molded polystyrene hanger.
4) Equal as approved by Architect before bidding. See Section 01 6000.

**2.02 OWNER-FURNISHED CLOCKS**

A. Wall Clocks:
   1. Approved Suppliers. See Section 01 6000 for definitions of Categories:
      a. Staples Advantage, PO Box 95708, Chicago, IL, phone (877) 295-0003, fax (800) 270-7611.
         1) Howard Miller model HOW625323.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Wall Clocks:
   1. Mount at height as shown and in locations as shown on Contract Drawings.

**END OF SECTION**

## SECTION 10 4400
## FIRE PROTECTION SPECIALTIES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

### 1.02 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.

### 1.03 SUBMITTALS

A. Product Data: Provide extinguisher operational features.

B. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, and rough-in measurements for recessed cabinets.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

E. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Include copy of final, executed warranty.
      b. Record Documentation:
         1) Testing and Inspection Reports:
            (a) Testing Agency Inspecting Reports of Drilled-In Mechanical Anchors / Adhesive Anchors / Screw Anchors.

### 1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Fire extinguishers shall be inspected and have annual inspection tag attached before Substantial Completion.

### 1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

### 1.06 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer's standard, written warranty on fire extinguisher.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Fire Extinguishers:

1. Approved Manufacturers. See Section 01 6000:
    a. Amerex Corp, Trussville, AL www.amerex-fire.com.
    b. Ansul Incorporated, Marinette, WI www.ansul.com.
    c. Buckeye Fire Equipment, Kings Mountain, NC www.buckeyef.com.
    d. Extinguishers private-labeled by manufacturers approved above are approved, with appropriate documentation.

B. Cabinets and Brackets:
1. Acceptable Manufacturers:
    a. J L Industries, Bloomington, MN www.jlindustries.com.
    b. Larsen's Manufacturing Co, Minneapolis, MN www.larsensmfg.com.
    c. Modern Metal Products / Technico, Owatonna, MN www.modern-metal.com.
    d. National Fire Equipment Ltd, Scarborough, ON www.nationalfire.com.
    e. Potter-Roemer, Cerritos, CA www.potterroemer.com.
    f. Samson Products Inc, City of Commerce, CA www.samsonproducts.com.
    g. Seton Inc, Richmond Hill, ON (905) 764-1122.
    h. Equal as approved by Architect before bidding. See Section 01 6000.

C. Acceptable Distributors:
1. W.W. Grainger, Inc., Lake Forest, IL www.grainger.com.
2. Equal as approved by Architect before bidding. See Section 01 6000.

## 2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Design Criteria:
1. Ten pound dry chemical ABC stored pressurized type equipped with pressure gauge and which does not need recharging except after use.
2. Instructions for repairs, maintenance, and recharging shall be attached.
3. Unit shall be tested and approved by UL and have minimum 4A:60-B:C UL rating. UL rating shall appear on extinguisher labels and be attached to and a part of fire extinguisher units.

## 2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Design Criteria:
1. Two-piece, semi-recessed or flush type depending on wall thickness, and have white baked enameled steel tubs with white baked enamel return trim and doors, clear acrylic glazing, ‘Safe-T-Lock,’ and cylinder locks.
2. Supply each cabinet with one specified fire extinguisher.

C. Acceptable Manufacturers:
1. Basis of Design Product: Ambassador 1017 G10 by J L Industries.
2. Equal as approved by Architect before bidding from Acceptable Manufacturer’s equivalent product. See Section 01 6000.

## 2.04 ACCESSORIES

A. Extinguisher Brackets:
   1. Design Criteria:
      a. Heavy duty with minimum of double strap/bracket.
   2. Approved Bracket. See Section 01 6000:
      a. Basis of Design Product: No. 846 by Larsen's.
      b. Equal as approved by Architect before bidding from Approved Manufacturer's equivalent product.

## 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. Securely Install cabinets and hangers plumb and level with wall surfaces.

C. Trim for cabinets shall be neat in appearance.

D. Place extinguishers in cabinets.

### 3.03 ADJUSTING

A. Fire extinguishers shall be inspected and have annual inspection tag attached before Substantial Completion.

**END OF SECTION**

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**SECTION 10 7430**
**ALUMINUM STEEPLE**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes but Not Limited To:
   1. Furnish and install steeple as described in Contract Documents, including application of sealants.

B. Related Requirements:
   1. Section 05 5000: 'Shop-Applied Metal Coatings' for quality of metal primer.
   2. Section 05 5000 - Metal Fabrications for quality of anchor rods.
   3. Section 05 5000 - Metal Fabrications for quality of metal support angles.
   4. Section 07 3113 - Asphalt Shingles for installation of Secondary Underlayment under Steeple.
   5. Section 07 9200 - Joint Sealants for quality of sealants.
   6. Section 26 4113 - Lightning Protection for Structures for lightning protection system from steeple to ground level.

### 1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

### 1.03 REFERENCES

A. Reference Standards:
   1. American Society of Civil Engineers (ASCE):
      a. ASCE 7, 'Minimum Design Loads for Buildings and Other Structures'.
   2. International Building Code (IBC latest approved edition):
      a. Chapter 15, 'Roof Assemblies and Rooftop Structures':
         1) Section 1509, 'Rooftop Structures':
         2) 1509.5, ‘Towers, Spires, Domes, and Cupolas’.
      b. Chapter 16, 'Structural Design':
         1) Section 1609 'Wind Loads'.
         2) Section 1613 ‘Earthquake Loads’.

### 1.04 QUALITY REQUIREMENTS

A. Sequencing:
   1. Steeple Support Enclosure to be completed before Steeple is installed.

B. Schedule:
   1. Provide eight (8) weeks minimum from approval of Shop Drawings to beginning of installation of Steeple.

### 1.05 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Shop drawings and calculations stamped and signed by Engineer in accordance with local building code requirements.

b. Show design load parameters, dimensions, adjacent construction, materials, thicknesses, core material thicknesses, fabrication details, required clearances, field jointing, tolerances, colors, finishes, method of support, integration of components, and attachment connections.
c. As required for proper handling and erection.

B. Informational Submittals:
1. Manufacturer Instructions:
a. Steeple Fabricator's erection instructions and drawings.
b. Steeple Fabricator's maintenance instructions.

C. Closeout Submittals:
1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
a. Operations and Maintenance Data:
1) Maintenance instructions.
b. Warranty Documentation:
1) Include final, executed copy of warranty.

## 1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Engineer registered in state in which Project is located.

B. Qualifications. Requirements of Section 01 4000 applies, but not limited to the following:
1. Steeple Fabricator specializing in aluminum steeple fabrication with ten (10) years' experience.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
1. Protect components during shipment by means of crates or padding so they arrive at project undamaged.
2. Unload and inspect components for imperfections or for damage incurred during shipping and transit procedures.
3. Replace damaged components at no additional cost to Owner.

B. Storage and Handling Requirements:
1. Maintain protection during storage on site before installation.

## 1.08 WARRANTY

A. Manufacturer Warranty:
1. Provide Steeple Fabricator's written warranty for material, workmanship, and installation.

# PART 2 PRODUCTS

## 2.01 SYSTEM

A. Fabricators:
1. Approved Fabricators. See Section 01 6000:
a. Campbellsville Industries Inc, Campbellsville, KY, (800) 467-8135, Fax: (502) 465-6839 www.cvilleindustries.com.
b. Munns Manufacturing, Tremonton, UT, phone (888) 774-7348, (435) 257-5673, Fax: (435) 257-3842 www.munnsmfg.com.

B. Performance:
1. Design Criteria:

a. Design and construct steeple to withstand a wind speed of 100 mph (161 kph) as defined by Section 1609 ‘Wind Loads’ of the International Building Code unless local codes require greater forces or per seismic requirements whichever are greater.
b. Design and construct steeple for a Seismic Design Category D per Section 1613 ‘Earthquake Loads’ of the International Building Code unless local codes require greater forces or per wind requirements whichever are greater.

C. Materials:
1. Base: Structural steel angles engineered and sized for steeple size and meeting requirements of ASTM A36/A36M.
2. Steeple:
a. Framing: Aluminum extrusions alloy 6061-T6.
b. Exterior Covering:
1) Aluminum Cladding: 0.032 inch (0.813 mm) thick minimum, alloy 3003-H14 minimum.
c. Louvers:
1) Formed from 0.032 inch (0.813 mm) thick aluminum skin.
2) Aluminum insect screen backing, 18x18 mesh, held taut with aluminum strapping.
3) Provide water pan at base of louver with proper weepage.
4) Provide formed supports at back of louver blades for widths exceeding 36 inches (900 mm).
d. Lightning Protection:
1) Provide clamp on structural member at bottom of tower or pigtail for connection of lightning protection cable provided under Section 26 4113.
2) UL approved for intended use.
3) Isolate dissimilar materials or provide components of compatible materials.

D. Fabrication:
1. Do not use wood or wood products in fabrication of steeple.
2. Base:
a. Paint steel elements with two (2) heavy coats of metal primer.
b. Isolate aluminum framing in contact with steel with material compatible with both aluminum and steel to prevent electrolysis.
c. Secure structural aluminum framing to steel base with appropriate size stainless steel bolts, with lock nuts and washers.
3. Steeple:
a. Framing: Fasten aluminum framing together with cold driven rivets, alloy 6061-T6, not loaded in tension and with one inch (25 mm) minimum spacing.
b. Exterior Covering: Use lock seams and conceal exterior fasteners as much as possible.
c. Cornices:
1) Form true to dimensions with vertical joints kept to a minimum.
2) Reinforced interior cornice profiles to resist wind loading during transit.
d. Finial: Formed aluminum of specified size and tapered to point, with spun aluminum ball.

E. Finish:
1. Fluorocarbon Carbon:
a. Comply with AAMA 2605.

b. Polyvinylidene Fluoride (PVDF) Resin-base finish (Kynar 500 or Hylar 5000) containing seventy (70) percent minimum (PVDF) in resin portion of formula and providing pencil hardness of 3H.
    1) Thermo-cured two-(2) coat system consisting of corrosion inhibiting epoxy primer and topcoat factory-applied over properly pre-treated metal:
c. Dip spun or fabricated shapes in caustic etch, coat with primer or epoxy and finish with exterior vinyl finish.
d. Finish shall be of such quality that shearing or forming encountered during fabrication will not separate finish from aluminum.
e. Color:
    1) Steeple: White.
    2) Steeple windows (if noted on Contract Drawings): Matte Black.
f. Approved Manufacturers. See Section 01 6000:
    1) BASF.
    2) PPG Industries, Inc.
    3) Valspar Corporation.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verification of Conditions:
1. Verify substrates and structural framing are ready to receive work and dimensions are as shown on shop drawings.
2. Verify site conditions are suitable and accessible for delivery and installation.
3. Before steeple placement, have support framing inspected by licensed structural engineer acceptable to Owner to ensure supporting elements are properly installed. Report problems with installation of supporting elements to Owner in writing before installing steeple.

### 3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using Steeple Fabricator's recommendations for substrate.

### 3.03 INSTALLATION

A. Special Techniques:
1. Install in accordance with Steeple Fabricator's handling and erection directions.
2. Clean all soiled and dirty areas and touch up any scratches or abrasions to finish before lifting into position.
3. Secure steel base to roof framing as described in Contract Documents.
4. Isolate dissimilar metals.
5. Bolted connections with Steeple Fabricator's sealant and apply to clean and dry surfaces.
6. Seal joints between steeple and other substrates with sealants recommended by Steeple Fabricator.

B. Interface with Other Work:
1. Coordinate with other trades as required to assure proper and adequate installation.
2. Install after square tube pipe boot as specified in Section 07 7200 - Roof Accessories, roofing membrane included for project, and after inspection to confirm that roofing membrane is weather tight.

### 3.04 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Remove installed steeple that has wrinkled or oil canning appearance, repair or replace and reinstall at no additional cost to Owner.

## 3.05 CLEANING

A. Installer to clean fabrications of foreign material using cleaning methods recommended in writing by Steeple Fabricator.

## 3.06 PROTECTION

A. General Contractor Responsibility:
   1. Protect steeple after installation, as recommended by Steeple Fabricator, until completion of Project.

**END OF SECTION**

## SECTION 11 3013
## RESIDENTIAL APPLIANCES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Kitchen appliances.

### 1.02 SUBMITTALS

A. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
   1. Provide Anti-Tip Bracket installation instructions for free-standing range.
   2. Catalog sheets before ordering items of equipment.

B. Shop Drawings:
   1. Complete utility drawings showing exact locations of electrical outlets and connections.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturers documentation:
            (a) Manufacturer's literature packaged for each appliance.

### 1.03 DELIVERY, STORAGE, AND HANDLING REQUIREMENTS

A. Delivery and Acceptance Requirements:
   1. General Contractor responsibility:
      a. Supervise unloading and handling for Owner Furnished Products.
      b. Range:
         1) Verify Anti-Tip Brackets are included. Contact Owner for missing brackets.

B. Storage and Handling Requirements:
   1. General Contractor responsibility:
      a. Provide secure location protected from weather and other trades.

### PART 2 PRODUCTS

### 2.01 OWNER-FURNISHED PRODUCTS

A. Manufactured Units:
   1. Free Standing Range:
      a. 30 inch (750 mm) free-standing conventional electric range with two 8 inch (400 mm) and two 6 inch (150 mm) calrod surface heating units.
   2. Free Standing Handicap Accessible Range (when required by AHJ):
      a. 30 inch (750 mm) free-standing model with two 8 inch (400 mm) and two 6 inch (150 mm) calrod surface heating units and controls AT FRONT.
   3. Single 30" built-in Oven (when ranges are not allowed by AHJ or where a fire suppression hood would be required with a range)
      a. Smart, Built-in, Self-Clean Single Wall Oven, General Electric Model JTS3000DNWW
      b. Dimensions: 28 5/8" H (727 mm) x 29 3/4" W (756 mm) x 26 3/4" D (680 mm)
   4. Refrigerator / Freezer:

a. 15.5 cu ft (0.44 cu meters) with top freezer compartment and reversible doors.
b. Dimensions: 64 inches (1 600 mm) high by 28 inches (700 mm) wide by 28-7/8 inches (722 mm) deep.

5. Microwave Oven:
a. 800 watts.
b. Dimensions: 12 inches (300 mm) high by 24 inches (200 mm) wide by 13 inches (325 mm) deep.

## 2.02 ACCESSORIES

A. Free Standing Range:
1. Anti-Tip Bracket.
2. Range Cord with 4 prong plug for new buildings and those built since 1995.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

## 3.02 INSTALLATION

A. General Contractor shall install all Owner Furnished Products as identified in this specification section:
1. Free Standing Range:
a. Anti-Tip Bracket provided by Owner Furnished Manufacturer:
1) Range must be secured by properly installed Anti-Tip Bracket.
2) Install bracket using Manufacturer's printed installation instructions (screws provided for wall mounting only).
3) Verify bracket is installed correctly and engaged properly:
(a) After installation of bracket, slide range into final location.
(b) Verify rear leveling leg must be fully inserted into bracket.
(c) Carefully tip range forward. DO NOT tip range more than 4 inches (100 mm).
(d) If bracket does not stop range within 4 inches (100 mm), bracket is NOT properly installed, and MUST be reinstalled and retested.

B. Install in accordance with manufacturer's instructions.

C. Anchor built-in equipment in place.

## 3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

## 3.04 SOURCE QUALITY CONTROL

A. Field Inspections:
1. Nameplates:
a. Each piece of equipment shall bear nameplate of suitable size, securely fastened to equipment.
b. Each piece of electrically operated or heated equipment shall bear nameplate showing complete electrical requirements and capacities.

## 3.05 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

**END OF SECTION 11 3013**

## SECTION 11 5213
## PROJECTION SCREENS

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Front projection screen assemblies - Owner-Furnished,

## 1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the efforts of the various trades affected by the Work of this Section.
   2. Coordinate completions of solid blocking in framed walls.
   3. Coordinate electrical service.

B. Sequencing:
   1. Install projections screens after following has been completed:
      a. Solid blocking installed in framed walls for projection screen brackets.
      b. Adjacent walls and ceilings are finished and painted.
      c. Motorized Projection Screen:
         1) Electrical connections and setting of limit switches has been completed.

## 1.03 SUBMITTALS

A. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used.

B. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Manufacturer's operating instructions.
      b. Record Documentation:
         1) Manufacturers Documentation:
            (a) Manufacturer's literature or cut-sheet.

## 1.04 WARRANTY

A. Provide manufacturer's standard warranty for projection screen assembly.

# PART 2 PRODUCTS

## 2.01 OWNER-FURNISHED PRODUCTS

A. Manufacturer
   1. Draper Inc, Spiceland, IN www.draperinc.com

B. Materials:
   1. Wall-Mounted or Ceiling-Mounted Motorized Projection Screen:
      a. Exposed, wall-mounted, electrically operated screen unit.
      b. Heavy-duty 2.5 amp ball bearing unit with 'stop in any position' and up and down factory preset limit switches.
      c. Chapel:

1) One (1) 192 inches (4.88 m) high by 192 inches (4.88 m) wide:
   (a) Flame retardant screen.
   (b) Matte white.
   (c) 7 foot (2.15 m) drop and reverse roll.
   (d) Screen operates instantly at touch of button and stops automatically in 'up' and 'down' positions.
2) Approved Products. See Section 01 6000 for definitions of Categories:
   (a) Targa Electric Project Screen by Draper.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that substrate is finished and ready to accept screen installation.

B. Verify solid blocking has been installed in framed walls for projection screen brackets.

C. Verify adjacent walls and ceilings are finished and painted.

D. Verify electrical work is complete for motorized projection screen(s).

E. Notify Architect in writing of inadequate conditions.

F. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

G. Verify that openings for recessed screens are correctly sized.

H. Verify that entrances to installation area are sized to permit entry of rigid screen.

I. Verify type and location of electrical connections.

J. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

### 3.02 PREPARATION

A. Coordinate screen installation with installation of projection systems.

B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

### 3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on drawings.

D. Handle rigid screen materials with care to avoid damage. Use equipment only on uncoated side.

E. Install plumb and level.

F. Install electrically operated screens ready for connection to power and control systems by others.

G. When installing electrical masking, do not damage underlying screen.

H. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

I. Test electrical screens for proper working condition. Adjust as needed.

J. Test masking systems for proper format control. Adjust as needed.

## 3.04 ADJUSTING

A. Ceiling-Mounted Motorized Projection Screen:
   1. Set limit switches so bottom of screen stops as follows:
      a. Rostrum: 3 feet (0.90 m) above finish floor of Rostrum.

## 3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 11 6623**
**GYMNASIUM EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Coordination, sequencing, and scheduling of Owner-Furnished Basketball equipment installation as described in contract documents including:
   1. Installation of Owner-Furnished-Installed basketball hanger brackets with bolts, nuts, and washers using manufacturers Informational Submittal for installation instructions and template.
   2. Furnish and install conduit, wiring, boxes, and electrical receptacle for Owner-Furnished basketball winch and operating switch using manufacturers Informational Submittal for wiring diagrams.

B. Owner-Furnished Scoreboards.
   1. Products installed but not furnished under this Section:
      a. Scoreboard.

C. Owner-Furnished Wall mounted protection pads.
   1. Products installed but not supplied under this Section:
      a. Safety Wall Padding on walls behind basketball backstops.

D. Owner-Furnished Volleyball nets and posts.
   1. Products installed but not furnished under this Section:
      a. Volleyball floor sleeves (anchors).
      b. Volleyball cover plates and outer rings.
      c. Volleyball upright (standard) storage unit.

### 1.02 REFERENCE STANDARDS

A. ASTM D3451 - Standard Guide for Testing Coating Powders and Powder Coatings 2006 (Reapproved 2017).

B. ASTM D7378 - Standard Practice for Measurement of Thickness of Applied Coating Powders to Predict Cured Thickness 2016.

C. ASTM D7803 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

E. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

B. Electrically Operated Equipment: Coordinate location and electrical characteristics of service connection.

C. Basketball Equipment Coordination:
   1. Coordinate the efforts of various trades affected by the Work of this Section.
   2. Coordinate completion of basketball hanger brackets with bolts, nuts, and washers.

a. Assure accurate installation of basketball hanger brackets using Owner-Furnished template.

3. Coordinate completions of operating switch.

D. Sequencing:

1. Install basketball standards after the following has been completed:
   a. Basketball hanger brackets have been installed.
   b. Adjacent walls and ceilings are finished.
   c. Building power is available in building for operating switch.

E. Scheduling:

1. Notify Owner-Furnished Product Manufacturer two (2) weeks minimum after installation of basketball hanger brackets.
   a. Submit template with bracket field dimensions with notification.

F. Volleyball Equipment Coordination:

1. Sequencing:
   a. Installation of Owner Furnished volleyball floor sleeves (anchors) by Section 03 3000.
   b. Installation of Owner Furnished volleyball upright (standard) storage unit before installation of carpet in Sports Storage Room by Section 06 2000.
   c. Installation of flooring material by flooring installer.
   d. Installation of Owner Furnished volleyball cover plates and outer rings by flooring installer.

## 1.04 SUBMITTALS

A. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:

1. Electrical characteristics and connection locations.
2. Fire rating certifications.
3. Manufacturer's installation instructions.

B. Color Selection Product Data: For Wall Padding.

C. Volleyball Equipment Submittals:

1. Manufacturer's literature and written installation instructions for volleyball floor sleeves and cover plates and outer rings.
2. Manufacturer's literature and written installation instructions for volleyball upright (standard) storage unit.

D. Manufacturer Instructions:

1. Manufacturer’s installation instructions and template for location of basketball hanger brackets.
2. Wiring diagrams.

E. Field Quality Control Submittals:

1. Field dimension of brackets as indicated on Manufactures template after installation by Section 06 1000.
2. Field dimension of brackets as indicated on Manufactures template after installation by Section 06 2000.

F. Closeout Submittals:

1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
    a. Operations and Maintenance Data:
        1) Operating and maintenance instruction.
        2) Parts list.
    b. Warranty Documentation:
        1) Final, executed copy of Warranty.
    c. Record Documentation:
        1) Manufacturers documentation:
            (a) Manufacturer's literature or cut sheet.
            (b) Color and style selection.

G. Maintenance Material Submittals:
    1. Extra Stock Materials:
        a. Touch-up paint.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

### 1.05 QUALITY ASSURANCE - BASKETBALL EQUIPMENT

A. The Owner-Furnished Product Manufacturer shall approve installer:
    1. Installer shall be experienced in installing basketball backstops.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Requirements of Section 01 6000 applies, but not limited to the following:
    1. General:
        a. Delivery of basketball standard is preferred to coincide with installation.
    2. Contractor’s Responsibility:
        a. Coordinate delivery with Owner-Furnished Product Manufacturer.
        b. Supervise unloading and handling. When necessary, provide assistance off-loading product with transportation carrier.
        c. Verify items received. Note any discrepancies on Delivery Receipt before driver leaves.
        d. Examine for visible evidence of damage such as holes, tears, or crushed portions of cartons and finish being scratched, gouged and/or damaged. Note findings on Delivery Receipt before driver leaves.
        e. Do not refuse any delivery because of damage:
            1) Note damage on Delivery Receipt and accept shipment.
            2) Notify Project Manager and Purchasing Coordinator to report findings within one (1) business day.
    3. Owner-Furnished Product Manufacturer’s Responsibility:
        a. Delivery:
            1) Deliver in Manufacturer’s original, unopened package(s) to project site.
            2) Delivery shall be no more than ten (10) days before start of installation of basketball standards.

B. Storage and Handling Requirements:
    1. Contractor’s Responsibility:

a. Provide secure location protected from the weather and other trades.
b. Do not remove packaging material.
c. Replace materials damaged due to job site neglect and damage at no cost to Owner.

### 1.07 WARRANTY

A. Provide five year manufacturer warranty for all labor, equipment, and materials for a period from the date of substantial completion of the building.

B. Special Warranty:
1. Limited Lifetime Warranty on glass backboard:
a. Warranty shall cover glass backboard against breaking during play of basketball only.
b. Warranty does not cover costs required in event of user abuse or neglect.
c. If backboard breaks under Warranty, then replacement part will be furnished at no charge to the Owner.

## PART 2 PRODUCTS

### 2.01 OWNER-FURNISHED BASKETBALL EQUIPMENT PRODUCTS

A. Manufacturer:
1. Approved Manufacturers. See Section 01 6000:
a. ADP Lemco Inc., Draper, UT, phone (801) 280-4000, www.adplemco.com.

B. Performance:
1. Design Criteria:
a. Backboard meets all NCAA and NFSHA specifications.
b. ‘Bolt On’ edge padding meets all NCAA, NFHS, and FIBA specifications.
c. Complete installation shall meet official basketball rules of NCAA.

C. Approved Products: Single Pole Design (Forward Fold, Forward Braced) (GRANGER 250, 250-SC, and 300):
1. Supports, Bracing, Drop Pipes, Sheaves, Etc:
a. Frame shall be forward fold, forward brace unit of single pole design, supported adequately to hold backboard in rigid position.
b. When folded, unit will be close to ceiling and will clear folding partition headers and equipment attached to them.
c. Pole Size:
1) 6-5/8 inch (168 mm) diameter minimum.
d. Quality Standard:
1) Front Fold Frame: Series 1325 Forward fold, front brace by ADP Lemco.
2. Operating Switch:
a. Rocker Arm Switch: Momentary contact, three-position, spring return to center, toggle type switch equal to Pass & Seymour p/n 1251-I.

D. Approved Products: Ceiling Mounted, Stationary, Ceiling Braced Design (HERITAGE 17-SC):
1. Single Pole, Ceiling Mounted, Stationary, Ceiling Braced Basketball Unit:
a. Front drop pipe assembly fabricated from 6-5/8 inch (168 mm) O.D. Pipe and supported with 2 inch (50 mm) square tubing with gussets suspended from bottom chord of roof trussed rafters. Fully weld frame.
b. Quality Standard: Series 1500 by ADP Lemco.

2. Backboard:
    a. Rectangular glass backboard.
    b. 40 by 54 inch (1 015 by 1 370 mm) rectangular.
    c. Quality Standard: Model 63-SW Glass Backboard by Lemco.
3. Cushion edge pad
    a. Quality standard: Model 105 'Bolt On' by ADP Lemco.
4. Basketball Goal:
    a. Quality standard: Model 20 by ADP Lemco.

## 2.02 OWNER-FURNISHED VOLLEYBALL EQUIPMENT PRODUCTS

A. Supplier:
    1. Approved Suppliers. See Section 01 6000:
        a. American Athletic Inc., Jefferson, IA www.aaispalding.com.
            1) Contact Information: Whitey Anson, cell (801) 699-3654, whitey.anson@fotlinc.com or ansongroup@aol.com.

B. Volleyball Floor Sleeves (Anchors), Cover Plate and Outer Ring, And Upright Storage Unit:
    1. Approved Products. See Section 01 6000:
        a. Design Criteria:
            1) Volleyball system with 3 inch (76 mm) outside diameter uprights as required for Owner furnished volleyball standards.
                (a) Volleyball floor plate consists of one (1) floor sleeve and one (1) cover plate.
                (b) Volleyball cover plate has hinged cover that closes to flush with finished flooring when volleyball standards are not use.
                (c) Volleyball upright (standard) storage unit designed to store two volleyball standards when not in use anchored to floor.
        b. Volleyball Floor Sleeves:
            1) Description:
                (a) Heavy duty steel tubing with 3-1/16 inch (79 mm) inner diameter.
                (b) Finish: baked blue powder coat finish.
            2) Model Number (consists of one (1) sleeve and one (1) cover plate package):
                (a) Cultural Center: Single: Model 408101 by American Athletic.
        c. Volleyball Cover Plate and Outer Ring:
            1) Cover Plate: 4-3/4 inch (120 mm) diameter hinged to outer ring.
            2) Outer Ring: 6-3/4 inch (171 mm) diameter placed over in floor sleeves.
            3) Attached to flooring with provided tapping screws.
            4) Finish: chrome plated.
        d. Volleyball Upright (Standard) Storage Unit:
            1) Description:
                (a) Two (2) metal sleeves: 3-1/4 inch (83 mm) by 8-3/4 inch (222 mm) tubing.
                (b) Base Plate: 1/4 inch (6.4 mm) by 3-1/2 inch (89 mm) wide by 18 inches (457 mm) long. Provide three (3) holes for 3/8 inch (9.5 mm) by 2-1/4 inch (57 mm) concrete anchors provided.
                (c) Finish: baked blue powder coat finish.

2) Locate in Sports Closet as shown on Construction Drawings used to store volleyball standards when not in use.
3) Volleyball upright (standard) storage unit Model 438-035 by American Athletic.

## 2.03 OWNER-FURNISHED WALL PADDING PRODUCTS

A. Approved Manufacturers. See Section 01 6200:
1. ADP Lemco Corporation, Draper, UT, phone (801) 280-4000, www.adplemco.com.

B. Material:
1. Safety Wall Padding:
a. Description:
1) Size: 24 inches (600 mm) by 72 inches (1 800 mm) by 1-1/2 inches (38 mm) minimum thickness.
2) Color:
(a) Cherry / Blue: Grey.
(b) OAK 95 / Blue: Grey.
(c) Cherry / Green: Forest Green.
(d) OAK 95 / Green ': Forest Green.
(e) Cherry / Red: Maroon.
(f) OAK 95 / Red: Maroon.
b. Design Criteria:
1) Padding with 2 inch (50.8 mm) thick fire retardant neoprene foam:
2) Meet NFPA 701 and ASTM E84 Class A rating for flame-spread and smoke development requirements.
3) Meet CSFM (California State Fire Marshall) approval for flame resistance (California projects only).
4) Cover material: 14 oz (414 mL) polyester laminated vinyl fabric.
5) Bond assembly to 3/8 inch (9.5 mm) plywood back.
2. Approved Product:
a. Model 2025 Safety Wall Padding by ADP Lemco.

C. Wall Pad Attachment System:
1. Description:
a. Attachment without exposed screws or bolts.
2. Approved Product:
a. Model 4196 Wall Pad Aluminum full Z-Clip attachment system by ADP Lemco.

## 2.04 OWNER-FURNISHED SCOREBOARD PRODUCTS

A. Approved Products. See Section 01 6000:
1. Approved Product.
a. All Sport 3000 by Daktronics Inc, Brookings, SD www.daktronics.com.

B. Performance:
1. Design Criteria:
a. LCD display with 7 inch (180 mm) high letters.
b. 24 inches (600 mm) high by 48 inch (1 219 mm) wide by 6 inch (150 mm) deep.

## 2.05 ACCESSORIES

A. Owner-Furnished Product Manufacturer’s Responsibility:
   1. Provide following Products to be installed by Contractor:
      a. Basketball hanger brackets with bolts, nuts, and washers.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.

B. Inspect areas and conditions before installation, and notify Architect in writing of unsatisfactory or detrimental conditions.

C. Do not proceed with this work until conditions have been corrected; commencing installation constitutes acceptance of work site conditions.

### 3.02 INSTALLATION

A. Install in accordance with Contract Documents and manufacturer's instructions.

B. Coordinate installation of inserts and anchors that must be built in to flooring or subflooring.

C. Install equipment rigid, straight, plumb, and level.

D. Basketball Equipment:
   1. Owner-Furnished Product Manufacturer’s Responsibility:
      a. Installation shall adhere to manufacturers printed instructions and accepted template.
      b. Mount electric winch exposed on standard:
         1) Install so motor / winch assembly will not move on pole.
      c. Apply Touch-up paint as required after installation or standard is completed.
   2. Contractor's Responsibility:
      a. Installation of Owner-Furnished basketball hanger brackets with bolts, nuts, and washers as per manufacturers written installation instructions, details, and dimensions as shown on Construction Drawings.
      b. Installation of conduit, wiring, boxes, and electrical receptacle for Owner-Furnished basketball winch and operating switch.

E. Volleyball Equipment:
   1. Volleyball Floor Sleeve:
      a. Follow Manufacturer's written installation instructions, details, and dimensions as shown on Construction Drawings.
         1) Wood Floor:
            (a) Install top of floor sleeve 1/4 inch (6.4 mm) minimum to 1/2 inch (12.7 mm) maximum height below top of finish wood floor.
         2) Carpet or Synthetic Athletic Floor:
            (a) Install top of floor sleeve flush with top of concrete building slab.
   2. Volleyball Cover Plate and Outer Ring:
      a. Follow Manufacturer's written installation instructions and install where shown on Contract Drawings including but not limited to:
         1) Cover plate shall be seated in outer rig so that it is flush with floor surface when closed.
         2) Attach to floor with tapping screws.

3. Volleyball Upright (Standard) Storage Unit:
    a. Follow Manufacturer's written installation instructions and install where shown on Contract Drawings including but not limited to:
        1) Drill hole at least 2-1/2 inch (64 mm) deep at each anchor.
        2) Install floor anchors to attach unit to floor.

## 3.03 FIELD QUALITY CONTROL

A. Tests:
    1. Owner-Furnished Product Manufacturer’s Responsibility:
        a. Operate standard sufficient number of times to assure correct adjustment and operation.

## 3.04 ADJUSTING

A. Verify proper placement of equipment.

B. Verify proper placement of equipment anchors and sleeves, and use actual movable equipment to be anchored if available.

C. Adjust operating equipment for proper operation; remove and replace equipment causing noise or vibration; lubricate equipment as recommended by manufacturer.

D. Basketball Equipment:
    1. Owner-Furnished Product Manufacturer's Responsibility:
        a. Set limit switches so standard stops in proper positions retracted and extended.

## 3.05 CLEANING

A. Remove masking or protective covering from finished surfaces.

B. Clean equipment in accordance with manufacturer's recommendations.

C. Building Damage:
    1. Owner-Furnished Product Manufacturer’s Responsibility:
        a. Installer responsible for repair of all damaged surfaces to their original condition from basketball installation.

D. Waste Management:
    1. Contractor’s Responsibility:
        a. Provide Dumpster as required in Section Owner.
    2. Contractor-Furnished Product Manufacturer’s Responsibility:
        a. All work areas are to be kept clean, clear and free of debris at all times.
        b. Disposal of rubbish, debris, and packaging materials to Contractor provided Dumpster.

## 3.06 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

C. Contractor's Responsibility:
    1. Upon completion of basketball installation, protect basketball equipment from damage and replace or repair subsequent damage at no cost to Owner.

**END OF SECTION**

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## SECTION 11 9116
## BAPTISMAL FONT MIRROR

### PART 1 GENERAL

### 1.01 SUMMARY

A. Includes but Not Limited To:
   1. Furnish and install mirror for font viewing, with installation brackets and hardware, as described in Contract Documents.

B. Related Requirements:
   1. Section 06 1000 - Rough Carpentry for installation of wall blocking for font angle brackets.

### 1.02 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass 2021.

### 1.03 QUALITY ASSURANCE

A. Certifications:
   1. Attach label to mirror showing strength, grade, thickness, type, and quality.

### PART 2 PRODUCTS

### 2.01 ASSEMBLY

A. Materials:
   1. Glass (Mirror):
      a. Meet requirements of ASTM C1036, Type I, Class I - Clear, Quality - q2 Mirror or q1 Mirror select.
      b. Thickness: 5/32 inch (4 mm) minimum (Double Strength).
      c. Size: 60 inches (1 500 mm) wide by 42 inches (1 050 mm) high.
   2. Backing:
      a. Sheathing: 23/32 inch (18 mm) thick minimum exterior APA rated plywood.
      b. Back Frame: 1 by 6 inch: (25 mm by 150 mm) Hardwood.
   3. Channel Frame:
      a. Stainless steel, Type 304, with No. 4 polished finish.
   4. Fasteners: Stainless steel.
   5. Brackets: Stainless steel, Type 304, with No. 4 polished finish.

B. Fabrication:
   1. Coordinate with Construction Drawings:
      a. Apply back frame to plywood and seal. Install brackets.
      b. Mount mirror against plywood with suitable mirror setting mastic applied over complete surface and install channel frame with mechanical attachment.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verification of Conditions:
   1. Verify wall blocking installed in correct location for angle brackets.
   2. Notify Architect and Owner in writing if wall blocking not in correct location for angle brackets.
      a. Do not install font mirror until deficiency in wall blocking have been corrected.

### 3.02 INSTALLATION

A. Install completed assembly as detailed as shown with Construction Drawings.

**END OF SECTION**

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## SECTION 11 9119
## BAPTISMAL FONT RAILING

# PART 1 GENERAL

## 1.01 SUMMARY

A. Includes but Not Limited To:
   1. Furnish and install glass railing for font viewing, with installation brackets and hardware, as described in Contract Documents.

## 1.02 REFERENCE STANDARDS

A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

## 1.03 SUBMITTALS

A. Informational Submittals:
   1. Qualification Statement:
      a. Installer:
         1) Provide Qualification documentation if requested by Architect or Owner.

## 1.04 QUALITY ASSURANCE

A. Certifications:
   1. Attach label to glass showing kind, class, and quality.

B. Qualifications:
   1. Installer: Requirements of Section 01 4000 applies, but not limited to following:
      a. Minimum two (2) satisfactorily completed installations of comparable quality, scope, similar size, and complexity in past two (2) years before bidding.
      b. Upon request, submit documentation.

# PART 2 PRODUCTS

## 2.01 ASSEMBLY

A. Materials:
   1. Glass:
      a. Meet requirements of ASTM C1048, Kind FT, Class 1, Quality Q4.
      b. Thickness: 1/2 inch (13 mm) minimum for openings up to 7 foor-6 inch (2 230 mm).
      c. Thickness: 3/4 inch (19 mm) minimum for openings up to 7 foor-7 inch (2 310 mm) to 10 foot 0 inch (3 050 mm).
   2. Intermediate Metal Posts: 1-1/2 inch (38 mm) square polished stainless steel, Type 304 tubing grouted into stainless steel, Type 304 sleeve in floor.
   3. Fasteners:
      a. Side:
         1) No. 12 SDSF Screws at 6 inch (150 mm) on center at wood or steel stud walls.
         2) 1/4 inch (6.35 mm) x 4 inch (100 mm) Screw Anchors at 6 inches (150 mm) on center (pre-drill holes).
      b. Bottom:
         1) 1/4 inch (6.35 mm) x 8 inch (200 mm) Screw Anchors at 18 inches (450 mm) on center at masonry or concrete (pre-drill holes).
   4. Glass Railing Channel:
      a. 5/8 inch (16 mm) x 5/8 inch (16 mm) for 1/2 inch (13 mm) glass thickness.

1) 20 gauge (1.0 mm) Stainless steel, Type 304 brushed finish.

b. 7/8 inch (22 mm) x 7/8 inch (22 mm for 3/4 inch (19 mm) glass thickness.

1) 18 gauge (1.0 mm) Stainless steel, Type 304 brushed finish.

**PART 3 EXECUTION:**

**3.01 INSTALLERS**

A. Acceptable Installers. See Section 01 6000.

1. Installers used shall follow Contract Document requirements.
2. Qualifications Requirements. See Section 01 4000.

B. Locations:

1. Idaho and Utah:
   a. Bountiful Glass, Bountiful, UT: Contact Jeff Pulver (801) 377-4355.
   b. Jones Paint & Glass, Provo, UT: Contact Brian Clark (374) 6711.
   c. Mollerup Glass, Salt Lake City, UT: Contact Brent (801) 397-1177.
   d. Tyler Glass & Mirror, Tyler TX: Contact Shannon (903) 597-6396.
   e. Western Glass, Ogden, UT: Contact Kaylee (801) 394-1661.

**END OF SECTION**

## SECTION 12 2216
## DRAPERY TRACK AND ACCESSORIES

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Curtains

B. Formed steel track.

C. Extruded aluminum track.

D. Nylon carriers, cords, and accessories.

## 1.02 DEFINITIONS

A. Approved Agency: An established and recognized agency that is regularly engaged in conducting tests of furnishing inspection services, where such agency has been approved by the building official.

B. Flame-proofing: Process of treating materials chemically so that they will not support combustion.

C. Flame Spread. The propagation of flame over a surface.

D. Flammable Material: Material capable of being readily ignited from common sources of heat or at a temperature of 600 deg F (316 deg C) or less.

E. Inherently Flame Resistant: Material that meets requirements set forth in NFPA 701. Inherently flame resistant fabric is woven from fibers that are non-combustible for life of material.

## 1.03 REFERENCE STANDARDS

A. ICC (IBC)-2018 - International Building Code; 2018.

B. NFPA 289 - Standard Method of Fire Test for Individual Fuel Packages; 2019.

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

## 1.04 SUBMITTALS

A. Product Data: Provide track profiles, acceptable load data, finishes available, and electrical characteristics and connection requirements, flame-proofing literature.

B. Shop Drawings: Indicate end track location, width of window opening, location of blocking for anchors, appurtenances and interferences, adjacent construction, operating hardware, and support bracket details.

C. Samples:
   1. 24 inch (600 mm) wide and 48 inch (1 200 mm) high sample including all specified elements of finished curtains, including flame retardant certification tag. Do not fabricate Project drapes until sample has been reviewed and approved by Architect.
   2. Submit sample with Product Data submittal. Sample will serve as standard by which to evaluate Project curtains.

D. Certificates: Certificate from approved agency showing compliance to IBC 806.4 requirements.

E. Qualification Statement:
   1. Fabricator/Installer:
      a. Provide Qualification documentation if requested by Architect or Owner.

F. Manufacturer's Installation Instructions: Indicate procedures, perimeter conditions requiring attention.

G. Maintenance Data: Include data for motor, shaft and gearing, lubrication frequency, control adjustments, spare part sources.

H. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Operating and maintenance instructions.
      b. Record Documentation:
         1) Manufacturers documentation:
            (a) Fabric Supplier's literature or cut sheets on fabric.
            (b) Curtain Rod Manufacturer's literature or cut sheets.
            (c) Color and style selection.
            (d) Certificate of compliance from approved agency.

## 1.05 QUALITY ASSURANCE

A. Fabricator / Installer: Requirements of Section 01 4000 applies, but not limited to following:
   1. Minimum three (3) satisfactorily completed installations of comparable quality, scope, similar size, and complexity in past two (2) years before bidding.
   2. Upon request, submit documentation.

# PART 2 PRODUCTS

## 2.01 ASSEMBLIES

A. Manufacturers / Suppliers:
   1. Conso / Wright, West Warren, MI www.conso.com.
   2. Coral, Div Charles Samelson, New York City, NY www.coralofchicago.com.
   3. Fred Krieger & Co. Inc., Jericho, NY www.fredkriegerfabrics.com.
   4. Graber Div of Springs Industries, Montgomery, PA www.graberblinds.com.
   5. Hanes Fabric Co, Conover, NC www.hanesfabric.com.
   6. InterSpec, Allenwood, NJ (800) 526-2800 or (732) 938-4114.
   7. Kirsch Co, Freeport, IL www.kirsch.com.
   8. Roc-lon Fabrics, New York, NY www.roc-lonfabrics.com.
   9. Rowley Co, Gastonia, NC. www.rowleyco.com.

B. Materials:
   1. Design Criteria:
      a. Meet requirements of IBC 806.4 'Acceptance Criteria And Reports':
         1) Where required to exhibit improved fire performance, curtains, draperies, fabric hangings and similar combustible decorative materials suspended from walls or ceilings shall be tested by an approved agency and meet the flame propagation performance criteria of Test 1 or 2, as appropriate, of NFPA 701, or exhibit maximum heat release rate of 100 kW when tested in accordance with NFPA 289, using 20 kW ignition source. Reports of test results shall be prepared in accordance with test method used and furnished to building official upon request.
      b. Attach permanent tag to each panel attesting to flame retardant quality of material used.
   2. Fabric:
      a. Approved Products. See Section 01 6000.
         1) Casements:

(a) 5th Avenue by Coral: Off White.
(b) Handcart by Fred Krieger: White, Snow.

2) Blackout Drapery.
(a) Apollo by Hanes: Optical White.
(b) FlameTrol 540 - White by Hanes.
(c) Blackout (3-pass) FR, white/ecru by Roc-lon Fabrics.

3) Crinoline/Buckram:
(a) Heavy or Extra Heavy grade, 4 inches (100 mm) wide, woven goods.
(b) Acceptable Products:
(1) BW74 by R H Rowley Co.
(2) 61421 by Conso.
(3) Equal as approved by Architect before use. See section 01 6200.

3. Drapery Hooks: Stainless steel, standard 1 1/2 inch (38 mm) hook with pointed hook top.
4. Drapery Rods:
a. Outside Mount:
1) Rods shall be sufficient width, window width plus 1/3, to allow drape to stack clear of window opening but no wider. This requirement may be modified as follows:
(a) Where Drawings detail differently.
(b) Where wall, cabinets, mechanical equipment, or other obstruction requires modification.
(c) Where symmetry of room would indicate desirability of exception.
b. Traverse rods shall include wall mounted spring-loaded tension pulleys for endless cord operation.
c. Approved Products. See Section 01 6000.
1) Kirsch:
(a) 'Architrac' Series 94005, baton draw: Less than 15 feet (4.57 m) long (classrooms, offices).
(b) 'Architrac' Series 94001, cord draw: 15 feet (4.57 m) long and longer.

C. Fabrication:
1. Double top and bottom hems unless specifically specified otherwise.
2. Provide necessary weights at seam and side hems.
3. Fullness shall be minimum of 2-1/2 times width of space covered by drape.
4. Space pleats 4 inches (100 mm) maximum center of pleat to center of pleat.
5. Drapes shall have:
a. Fabric inspected over back-lite table for flaws.
b. Straight, even blind-stitched side and bottom hems.
c. Seams hidden beside pleats.
d. Joined seams surged and overcast with no puckering.
e. 4 inch (100 mm) double bottom hems and headings.
f. 1-1/2 inches (38 mm) double side hem.
g. 2 inch (50 mm) overlap, total of 4 inches (100 mm) on pair.
h. Stack-off of 1/3 of window width.
i. Specified woven, permanent crinoline / buckram used in heading.
j. Seams match up on bottom hems.

k. Corners of bottom hems closed with hand stitching.
l. Pleats evenly spaced to size.
m. Straight edge across top after pleating.
n. Straight, even folds.
o. Polyester thread matching fabric color for seams and hems.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that concealed anchors are in correct position.

B. Verify that electrical service is correctly located and of proper characteristics.

### 3.02 INSTALLATION

A. Install drapery tracks in accordance with manufacturer's instructions.

B. Install tracks, wall or ceiling mount, with mounting device head no larger than No. 6, to yield direct withdrawal strength of 25 lbs (11 kg) minimum.

C. Support spacing to be as recommended in Manufacturer's literature.

D. Install blackout drapery as a separate drape on separate rod behind primary drape.

### 3.03 CLEANING

A. Tracks to be free of marring, scratches, and foreign material.

**END OF SECTION 12 2216**

## SECTION 12 2400
## WINDOW SHADES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Interior manual roller shades.

### 1.02 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.

### 1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this type with minimum [__5__] years of documented experience with shading systems of similar size and type.
   1. Manufacturer's authorized representative.
   2. Factory training and demonstrated experience.

### PART 2 PRODUCTS

### 2.01 MANUFACTURED UNITS

A. Manufacturer:
   1. Acceptable Products and Manufacturers:
      a. RB-500 by Hunter Douglas Contract, Poway, CA www.hunterdouglascontract.com.
      b. Equal meeting design criteria requirements as approved by Architect before bid. See Section 01 6000.

B. Materials:
   1. Design Criteria:
      a. R-24 Clutch by RollEase.
   2. Fabric:
      a. Room darkening single-fabric shadecloth:
         1) Design Criteria:
            (a) Fiberglass with vinyl.
            (b) Openness: 0 percent (blackout).
            (c) Washable.
            (d) 11 oz per sq yd (373 g per sq m).
            (e) Meet ASTM G21 15: ‘Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi'.
            (f) Comply with NFPA 701-2015, 'Methods of Fire Tests for Flame Propagation of Textiles and Films'.
      b. Color quality standard:
         1) White or off white.
   3. Drive Chain:
      a. Design Criteria:
         1) Chain:
            (a) #10 qualified stainless steel chain.

(b) Chain rated to 90 lb (40.8 kg) minimum breaking strength.
(c) Nickel plate chain shall not be accepted because of rusting.
2) Chapel:
(a) Bottom of chain not lower than 48 inch (1 200 mm) above finish floor.
3) Cultural Hall.
(a) Bottom of chain not lower than 66 inches (1 675 mm) above finish floor.
b. Provide 'Spring Assist' on shades that are greater than 10 lbs (4.5 kg) pulling weight.
4. Child Safe Tension Device:
a. Acceptable Product:
1) Model VC-611-12 by ZMC Window Covering Supplies.
2) Equal as approved by Architect before installation. See Section 01 6000.

C. Fabrication:
1. Shade Bands:
a. Description:
1) Construction of shade band includes fabric, hem weight, hem-pocket, shade roller tube, and attachment of shade band to roller tube.
b. Hem Pockets and Hem Weights:
1) Design Criteria:
(a) Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights.
(b) Hem weights shall be of appropriate size and weight for shade band.
(c) Hem weight shall be continuous inside sealed hem pocket.
(d) Hem pocket construction and hem weights shall be similar, for shades within one (1) room.
c. Shade Band And Shade Roller Attachment:
1) Design Criteria:
(a) Shade Roller Tube:
(b) Use extruded aluminum shade roller tube of diameter and wall thickness required to support shade fabric without excessive deflection.
(c) Roller tubes less than 1.5 inch (38 mm) in diameter for manual shades are not acceptable.
(d) Provide for positive mechanical engagement with drive / brake mechanism.
(e) Provide for positive attachment of shade band to roller tube.
(f) Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
2. Shades:
a. Design Criteria:
1) Fabricate units to completely fill openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
2) Shadecloth:
(a) Fabricate shadecloth to hang flat without buckling or distortion.
(b) Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling.

(c) Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3 mm) in either direction per 8 feet (2.45 m) of shade height due to warp distortion or weave design.

(d) Fabricate hem with bottom hem weights.

3) Provide battens in standard shades as required to assure proper tracking and uniform rolling of shadebands.

(a) Assure that width-to-height (W:H) ratios shall not exceed Manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards.

(b) Battens shall be roll-formed stainless steel or tempered steel, as required.

4) Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed Manufacturer's standards.

(a) In absence of Manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

5) Battens shall be roll formed of stainless steel or tempered steel and concave to match roller tube contour.

6) Batten Pockets:

(a) Batten pockets shall be self-colored fabric front and back RF welded into shadecloth.

(b) Provide self-color opaque liner front and back to eliminate any see through of batten pocket that shall not exceed 1-1/2 inches (38.1 mm) high and be totally opaque.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

### 3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

### 3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

D. Install roller shade in accordance with manufacturer's instructions including recommended support brackets and fasteners on inside of storefront exit door.

E. Attach roller shade on exit door in classroom above panic device.

### 3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

## 3.05 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

## 3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

**END OF SECTION**

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**SECTION 12 6100**
**PEWS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Related Requirements:
   1. Section 01 1000: Owner will furnish and install Pews. This Section establishes quality of materials and installation for information of Contractor, Architect, and Owner's Representatives.
   2. Section 01 4000: Quality Assurance – Qualifications.
   3. Section 09 9300: 'Interior Clear-Finished Hardwood' for pew finish.

### 1.02 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM B633-15, 'Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel'.
      b. ASTM E488/E488M-18, 'Standard Test Methods for Strength of Anchors in Concrete Elements'.
      c. ASTM F1554-18, 'Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength'.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the efforts of the various trades affected by the Work of this Section.
   2. Coordinate completion of pews.

B. Sequencing:
   1. Owner will Install pews after the following as been completed:
      a. Adjacent walls and ceilings are finished and painted.
      b. Adjacent hardwood trim installed and finished.
      c. Carpet flooring has been installed.

C. Scheduling:
   1. Notify Manufacturer early in project schedule when pews will be ready for installation.

### 1.04 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Include final, executed copy of warranty.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements: Requirements of Section 01 6600 applies, but not limited to the following:
   1. Owner-Furnished Product Manufacturer's Responsibility:
      a. Deliver in Manufacturer's original, unopened package(s).
      b. Handling and unloading.

c. Replace damaged materials at no cost to Owner.

B. Storage And Handling Requirements:
1. Owner-Furnished Product Manufacturer's Responsibility:
a. Protect pews from damage during installation.

## 1.06 WARRANTY

A. Manufacturer Warranty:
1. Manufacturer's warranty against defects for five (5) years from date of Substantial Completion.

# PART 2 PRODUCTS

## 2.01 OWNER-FURNISHED PRODUCTS

A. Marshall Company, Payette, ID www.marshallpews.com.

B. Sauder Manufacturing Co, Archbold, OH www.sauderworship.com.

C. Materials:
1. Red Oak.
2. Miscellaneous Hardware: Manufacturer to supply necessary screws, washers, and miscellaneous hardware for complete pew assembly and installation.

## 2.02 SOURCE QUALITY CONTROL

A. Inspections:
1. Permanently identify Manufacturer's name, address, model, and fabric color on under side of each pew.
2. Clear Finished Hardwood:
a. Color matches Owner provided sample specified in Section 09 9324.

# PART 3 EXECUTION

## 3.01 OWNER-FURNISHED PRODUCT INSTALLATION

A. Pew Attachment:
1. General:
a. Follow Manufacturer's written installation instructions.
b. Spacing and alignment shall be uniform and true.
c. When installing over carpet, punch holes through carpet with hollow cutting tool. Do not drill thru carpet.
2. Concrete Installation:
a. Attachment to floor with anchors at each pew end or pew support.
b. Embed anchor 1-3/4 inches (45.4 mm).
c. Drill hole same diameter as anchor to depth equal to embedment required:
1) Tolerances of drill bit used should meet requirements of ANSI B212.15.
2) Do not over drill hole.
3) Clean hole.
d. Drive anchor with expander plug in bottom.
e. Expand anchor by driving anchor over plug with hammer.
3. Wood Installation (Rostrum):
a. Attachment to floor with two (2) anchors at each pew end or pew support required.

b. Embed ‘Machine and Wood Threaded Lag Bolt’ to 1-1/2 inches (38 mm) depth.

4. Secure pew end or pew support to floor.

## 3.02 CLEANING

A. General:

1. Owner-Furnished Product Manufacturer’s Responsibility:

a. Clean any soiling of pews as recommended by Manufacturer or any surrounding areas caused by installation of pews.

## 3.03 BUILDING DAMAGE:

A. Owner-Furnished Product Manufacturer’s Responsibility:

1. Installer responsible for repair of all damaged surfaces to their original condition from pew installation.

## 3.04 WASTE MANAGEMENT:

A. Contractor’s Responsibility:

1. Provide Dumpster as required in Section 01 7400.

B. Owner-Furnished Product Manufacturer’s Responsibility:

1. All work areas are to be kept clean, clear and free of debris at all times.
2. Disposal of rubbish, debris, and packaging materials to Contractor provided Dumpster.

## 3.05 PROTECTION

A. General:

1. Contractor’s Responsibility:

a. Upon completion of pew installation, protect pews from damage and replace or repair subsequent damage at no cost to Owner.

**END OF SECTION**

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**SECTION 21 1313**
**WET-PIPE SPRINKLER SYSTEMS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete fire sprinkler system as specified in Contract Documents.
   2. Furnish and install Firestop Penetration Systems for plumbing systems penetrations as described in Contract Documents.

### 1.02 RELATED REQUIREMENTS

A. Section 01 7000: 'Closeout Submittals'.

B. Section 28 4600: 'Fire Detection and Alarm System' for fire detection and alarm annunciation panels including connection of tamper switches and pressure flow detectors to alarm system and furnishing and installing of low temperature switch.

C. Section 28 4600 Fire Detection and Alarm

D. Section 33 1416 Site Water Utility Distribution Piping : .

### 1.03 REFERENCE STANDARDS

A. ASME B1.20.1-2013 ‘Pipe Threads, General Purpose (Inch)’.

B. ASME B1.20.1M-2006 (R2011), ‘Pipe Threads, General Purpose (Metric)’.

C. ASME B16.1-2015, ‘Grey Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250’.

D. ASME B16.3-2011, 'Malleable Iron Threaded Fittings: Classes 150 and 300’.

E. ASME B16.4-2011, 'Gray Iron Threaded Fittings, Classes 125 and 250’.

F. ASME B16.5-2013, ‘Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard’.

G. AWWA C606-15, ‘Grooved and Shouldered Joints’.

H. AWA B2.1/B2.1M-2014, ‘Specification for Welding Procedure and Performance Qualification', (5th Edition).

I. ASTM A53/A53M-12, ‘Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless’.

J. ASTM A135/A135M-09 (2014), ‘Standard Specification for Electric-Resistance-Welded Steel Pipe’.

K. ASTM A234/A234M-17, ‘Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service’.

L. ASTM A395/A395M-99 (2014), ‘Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures’.

M. ASTM A536-84 (2014), ‘Standard Specification for Ductile Iron Castings’.

N. ASTM A795/A795M-13, ‘Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use’.

O. NFPA 13, 'Standard for the Installation of Sprinkler Systems' (2016 Edition or latest AHJ approved edition).

P. NFPA 24, 'Standard for the Installation of Private Fire Service Mains and their Appurtenances' (2016 Edition).

Q. NFPA 25, 'Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems' (2014 Edition).

R. NFPA 101, 'Life Safety Code' (2015 Edition).

S. UL Directory B, 'Fire Protection Equipment, Directory B' (2011).

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of [____] with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

D. Scheduling: [____].

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Action Submittals:
   1. Shop Drawings:
      a. Size sprinkler system using NFPA 13 hydraulic calculation design method based on water supply evaluation performed at building site:
         1) On submittals, refer to sprinkler heads by sprinkler identification or model number published in appropriate agency listing or approval. Trade names and other abbreviated designations are not acceptable.
            (a) Grooved joint couplings and fittings shall be shown on drawings and product submittals and be specifically identified with applicable Victaulic styles or series numbers.
      b. Submittal Procedure:
         1) After award of Contract and before purchase of equipment, submit seven sets of shop drawings with specifications and hydraulic calculations, if pipe schedule method is not used, to Fire Sprinkler Consultant and two sets to local jurisdiction having authority for fire prevention for review.
         2) After integrating Fire Sprinkler Consultant's and local jurisdiction's comments into drawings, licensed certified fire protection engineer of record submitting fire sprinkler system design construction documents shall stamp, sign, and date each sheet of shop drawings and first page of specifications and calculations.
         3) Submit stamped documents to area office and local jurisdiction having authority for fire prevention for final approval.
         4) After final approval, submit four copies of approved stamped documents to Fire Sprinkler Consultant.
         5) Failure of system to meet requirements of authority having jurisdiction shall be corrected at no additional cost to Owner.

C. Informational Submittals:
   1. Certificates:
      a. Provide one (1) copy of completed NFPA 13 'Contractor's Material and Test Certification for Aboveground Piping' as specified in 'Field Quality Control' in Part 3 of this specification:
   2. Qualification Statement:
      a. Licensed fire protection engineer or fire protection system designer:
         1) Licensed for area of Project.
         2) Certified by NICET to level three minimum.
         3) Provide Qualification documentation if requested by Fire Sprinkler Consultant or Owner’s Representative.
      b. Installer:
         1) Provide Qualification documentation if requested by Fire Sprinkler Consultant or Owner’s Representative.

D. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:

a. Operations and Maintenance Data:
    1) Maintenance and instructions.
        (a) List of system components used indicating name and model of each item.
        (b) Manufacturer's maintenance instructions for each component installed in Project.
        (c) Instructions shall include installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
b. Warranty Documentation:
    1) Include copies of required warranties.
c. Record Documentation:
    1) Include copies of approved shop drawings.
    2) Provide master index showing items included.
    3) Provide name, address, and phone number of Architect, Fire Sprinkler Consultant, General Contractor, and Fire Protection subcontractor.
    4) Provide operating instructions to include:
        (a) General description of fire protection system.
        (b) Step by step procedure to follow for shutting down system or putting system into operation.
    5) Provide signed copy of NFPA 13 'Contractor's Material and Test Certification for Aboveground Piping'.

2. Instruction of Owner (as specified in Part 3 of this specification):
    a. Provide Owner with latest version of NFPA 25.

E. Maintenance Materials Submittals:
1. Extra Stock Materials:
    a. Six (6) spare sprinkler heads selected in representative proportion to quantity used in Project and in accordance with NFPA 13. Do not include Pendent and sidewall dry barrel sprinkler heads.
    b. Provide spare heads in cabinet with sprinkler head wrench for each type of head used. After approval of cabinet and contents, mount cabinet in convenient location in Riser Room.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.06 QUALITY ASSURANCE**

A. Requirements of Regulatory Agencies:
1. Unless noted otherwise, system shall conform to:
    a. NFPA 13 for Light & Ordinary Hazard Occupancies.
    b. NFPA 24 for Service Mains and Their Appurtenances, Private.
    c. NFPA 25, for ‘Inspection, Testing, and Maintenance.
    d. NFPA 101, for Life Safety Code.
    e. Requirements of local water department and local authority having jurisdiction for fire protection.
    f. Underwriters Laboratories Publication, 'Fire Protection Equipment Directory' (Current Edition at time of Pre-Bid Meeting).
    g. Comply with backflow prevention requirements and, if required, include device in hydraulic calculations.
    h. Applicable rules, regulations, laws, and ordinances.

B. Qualifications:
1. Licensed fire protection engineer or fire protection system designer certified by NICET to level three minimum and engaged in design of fire protection systems. Engineer / designer shall:
    a. Licensed for area of Project.

b. Minimum five (5) years experience in fire protection system installations.
c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
d. Be responsible for overseeing preparation of shop drawings, hydraulic calculations where applicable, and system installation.
e. Make complete inspection of installation.
f. Provide corrected record drawings to Owner with letter of acceptance.
g. Certify that installation is in accordance with Contract Documents.
h. Upon request, submit documentation.

2. Installer:
a. Licensed for area of Project.
b. Minimum five (5) years experience in fire protection system installations.
c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
d. Upon request, submit documentation.

C. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
1. Do not deliver system components until proper protection can be provided.
2. Accept valves on-site in shipping containers with labeling in place.
3. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage and Handling Requirements:
1. Protect all components from damage and corrosion.
2. Store items subject to moisture damage in dry, heated spaces.
3. Leave protective coverings and packaging in place until time of installation.

## 1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty:
1. Pipe Boot:
a. Provide thirty-five (35) year limited Product Warranty.

# PART 2 PRODUCTS

## 2.01 SYSTEM

A. Manufacturers:
1. Manufacturers Contact List:
a. AGF Manufacturing, Inc , Malvern, PA 19355 www.agfmanufacturing.com
b. Croker Corp, Elmsford, NY www.croker.com.
c. Gruvlock by Anvil International, Portsmouth, NH www.anvilintl.com.
d. H O Trerice Company, Oak Park, MI www.hotco.com.
e. Kennedy Valve, Elmira, NY www.kennedyvalve.com.
f. Milwaukee Valve Co, New Berlin, WI www.milwaukeevalve.com.
g. Mueller Company, Decatur, IL www.muellerflo.com.
h. Nibco Inc, Elkhart, IN www.nibco.com.
i. Noble Company, Grand Haven MI www.noblecompany.com.
j. Notifier by Honeywell, Northford, CT www.notifier.com.
k. Potter Electric Signal Co, St Louis, MO www.pottersignal.com.

l. Potter-Roemer, Cerritos, CA www.potterroemer.com.
m. Prinzing, Milwaukee, WI www.prinzing.com.
n. Reliable Automatic Sprinkler Co, Mount Vernon, NY www.reliablesprinkler.com.
o. System Sensor, St Charles, IL www.systemsensor.com.
p. TYCO Fire & Building Products, Lansdale, PA www.tyco-fire.com.
q. Viega LLC 585 Interlocken Blvd Broomfield, CO 80021 https://www.viega.us/en/homepage.html
r. Victaulic Company of America, Easton, PA or Victaulic Company of Canada, Rexdale, ON www.victaulic.com.
s. Viking Corp, Hastings, MI www.vikingcorp.com.
t. Equal as approved by Architect before bidding. See Section 01 6200.

B. Description:
1. Automatic wet-pipe fire sprinkler system starting at flange in Fire Riser Room and extending throughout heated portions of building.
2. Dry sprinkler heads connected towet system over and into Vestibules.

C. Performance:
1. Design Criteria:
a. Area of Application and Corresponding Design Density:
1) Serving Area and Mechanical, Electrical, and Janitorial Areas:
(a) Ordinary Hazard Group 1.
(b) Design density = 0.15 gpm per sq ft over 1,500 sq ft (140 sq m).
2) Storage Areas:
(a) Ordinary Hazard Group 2.
(b) Design density = 0.20 gpm per sq ft over 1,500 sq ft (140 sq m).
3) All Other Areas:
(a) Light Hazard.
(b) Design density = 0.10 gpm per sq ft over 1,500 sq ft (140 sq m).
4) Increase remote areas by 30 percent where ceiling / roof is sloped more than 2 inches (50 mm) per ft.
5) Remote areas may be reduced within parameters indicated in NFPA 13 for use of quick response sprinklers throughout.
b. Maximum Coverage per Sprinkler Head:
1) Ordinary Hazard Areas: 130 sq ft (12.1 sq meters).
2) Attic Areas: 120 sq ft (11.2 sq meters).
3) Light Hazard Areas: 225 sq ft (20.1 sq meters).
c. Design Area shall be hydraulically most remote area in accordance with NFPA 13.
1) Provide a 10% safety allowance under adjusted water flow supply curve.
d. Maximum velocity of water flow within piping: 20 feet (6.1 m) per sec.

D. Components:
1. General: Use only domestically manufactured cast iron pipe fittings, valves, sprinkler heads, and other components.
a. Pipe of foreign manufacture that meets ASTM Standards is acceptable.
b. Ductile iron fittings of foreign manufacture are acceptable.
2. Pipe:
a. **Schedule 40** Welded Steel:
1) Exterior, Above Ground: Schedule 40 hot-dip galvanized welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
2) Interior, Above Ground: Schedule 40 black welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
3) Connections:
(a) 2 inches (50 mm) And Smaller: Screwed, flanged, or roll grooved coupling system.

(b) 2-1/2 inches (64 mm) And Larger: Flanged or roll grooved coupling system.

3. Fittings:
   a. Usage:
      1) 2 inches (50 mm) And Smaller: Welded, screwed, flanged, press, or roll grooved coupling system. For use with schedule 40 carbon steel pipe.
      2) 2-1/2 inches (64 mm) And Larger: Welded, flanged, or roll grooved coupling system.
   b. Types And Quality:
      1) Screwed:
         (a) Cast iron meeting requirements of ANSI B 16.4 or ductile iron meeting requirements of ANSI B 16.3 and ASTM A536, Grade 65-45-12.
         (b) Threaded fittings and pipe shall have threads cut to ANSI B1.20.1.
         (c) Do not extend pipe into fittings to reduce waterway.
         (d) Ream pipe after cutting to remove burrs and fins.
      2) Flanged: Steel meeting requirements of ANSI B16.5.
      3) Welded:
         (a) Carbon steel meeting requirements of ASTM A234/A234M.
         (b) Weld pipe using methods complying with AWS B2.1, level AR-3. Welding procedures and performance of welders shall comply with ASW B2.1, level AR3.
      4) Press
         (a) Approved Product
            (1) Viega MergPress for Black Iron 1/2 inch to 2 inch and/or current offerings.
      5) Roll Grooved Pipe Coupling System:
         (a) Ductile iron meeting requirements of ASTM A395/A395M and ASTM A536, and UL / CASA listed and FM approved.
         (b) Grooved products used on Project shall be from same manufacturer. Grooving tools shall be as recommended by manufacturer of grooved products.
         (c) Approved Products. See Section 01 6200:

| | Grulvok | Tyco | Victaulic | Viking |
|---|---|---|---|---|
| Rigid Couplings | 7401 | 772 | Style 005 | V-Z05 |
| Flexible Couplings (*1) | 7000 | 705 | Style 75 | V-7705 |
| Flange Adaptors (*2) | 7012 | 71 | Style 744 | V-7041 |
| Grooved Coupling Gaskets (*3) | 'E' EPDM | 'E' EPDM | 'E' EPDM (*4) | E-EPDM |

            (1) Use in locations where vibration attenuation and stress relief are required.
            (2) Class 125 or 150.
            (3) Temperature rated 30 to 150 deg F (minus one to 65 deg C). NSF-61 certified.
            (4) Grade ‘A’
   c. Use of saddle or hole cut type mechanical tees is NOT APPROVED.
4. Valves:
   a. Air Venting Valves
      1) Design Criteria:
         (a) Shall be located near a high point in the system to allow air to be removed from that portion of the system.
         (b) Locate where most effective. Multiple locations, if needed are allowed.

(c) Manual ball valve, minimum ½ inch, with hose connection and cap

b. Butterfly Valves:
   1) UL / CASA / FM approved.
   2) Indicating type.
   3) Approved Products.
      (a) Milwaukee:
         (1) Model BB-SC502 threaded ends with tamper switch one inch (25 mm) to 2 inches (50 mm).
         (2) Model BBV SC502 Grooved ends with tamper switch 2 inches (50 mm) to 2-1/2 inches (64 mm).
      (b) Nibco:
         (1) WD3510-4 Wafer type with valve tamper switch.
         (2) GD4765-8N Grooved type with valve tamper switch, 2-1/2 inches (64 mm) to 8 inch (200 mm).
      (c) Tyco (Grinnell):
         (1) Model TFP1515 wafer.
         (2) Model TFP1510 Grooved.
      (d) Victaulic: Series 705-W Grooved end type with internal supervisory switches.
      (e) Kennedy:
         (1) Model 01W wafer.
         (2) Model 01G grooved.

c. Gate Valves:
   1) UL / CASA / FM approved.
   2) Outside Screw and Yoke Type (O.S.&Y).
   3) Class 150 psi (1.03 MPa).
   4) Approved Products.
      (a) Nibco:
         (1) T-1040 with Threaded Ends 1/2 inch (12.7 mm) to 2 inches (50 mm).
         (2) F-637-31 Flanged Ends.
      (b) Mueller: R-2360-6 Flanged Ends.
      (c) Victaulic: Series 771 Grooved Ends.

d. Ball Valves:
   1) UL / CASA / FM approved.
   2) Valve tamper switch.
   3) Approved Products.
      (a) Milwaukee: BB-SCS02 with threaded ends.
      (b) Nibco:
         (1) KT-505 with threaded ends.
         (2) KG-505 with grooved ends.
      (c) Victaulic: Series 728 with grooved or threaded ends.

e. Swing Check Valves:
   1) 2 to 4 inch (50 to 100 mm), grooved ends, ductile iron, 300 psi (2.07 MPa).
      (a) Regrinding type.
      (b) Renewable disk.
      (c) Bronze Class 125 with threaded ends.
      (d) Approved Products.
         (1) Nibco: KT-403-W.
         (2) Tyco (Grinnell): CV-1F grooved ends.
         (3) Victaulic: 712.
         (4) Viking: G-1 grooved ends.
   2) 3 to 12 inch Horizontal Check:
      (a) Bolted bonnet.

(b) Raised face flanges.
(c) Bronze mounted with ductile iron body.
(d) 125 lb Class A.
(e) Approved Products.
(1) Nibco: F-938-31.
(2) Mueller: A-2120-6.
(3) Viking: F-1 grooved and flanged.

f. Wafer Type Check Valves:
1) 4 to 8 inch (100 to 200 mm) cast iron body.
2) 175 psi minimum working pressure.
3) Rubber Seat.
4) Approved Products.
(a) Nibco: KW-900-W.
(b) Mueller: A-2102.
(c) Kennedy: Fig. 706.

g. Grooved-End Check Valves:
1) 2-1/2 to 12 inch (64 to 300 mm) ductile iron body.
2) 250 psi maximum working pressure.
3) Disc And Seat:
(a) 2-1/2 And 3 Inch (64 to 76 mm): Aluminum bronze disc with mounted elastomer seal and PPS (polyphenylene sulfide) coated seat.
(b) 4 Inch (100 mm) And Larger: Elastomer encapsulated ductile iron disc with welded in nickel seat.
4) Approved Products.
(a) Victaulic Series 717.
(b) Kennedy: Fig. 426.

h. Retard Chamber
1) Design Criteria:
(a) Self-draining.

i. Approved Products:
1) Reliable: E-1.
2) Victaulic: Series 752.
3) Viking: C-1.

j. Inspector's Test Valve:
1) Design Criteria:
(a) Bronze body with threaded or grooved ends.
(b) Combination sight glass / orifice.

k. Approved Products.
1) Reliable Model TD or TD with optional relief valve kit.
2) Tyco (Grinnell): Model F350.
3) Victaulic: Testmaster Alarm Test Module Style 720.
4) Viking 3011ASG [includes pressure relief] or Viking 3011SG.

l. Inspector's Test Valve:
1) Combination sight glass/orifice.
(a) Bronze top works.
(b) Approved Products.
(1) Reliable Model TD or TD with optional Refief valve kit.
(2) Tyco (Grinnell): Model F350.
(3) Victaulic: Testmaster II Alarm Test Module Style 720.
(4) Viking 3011ASG [includes pressure relief] or Viking 3011SG.

5. Sprinkler Heads:
a. Concealed Pendant:
1) Design Criteria:

(a) Adjustable cover.
(b) UL / CASA listed and approved.
(c) Concealed Cover Finish: White.

2) Acceptable Products:
(a) Wet Pendant, Flat Profile:
(1) Reliable: F4FR.
(2) Victaulic: Model 3802.
(3) Viking: Model VK462.
(4) Tyco (Grinnell): Model RF11.
(5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.
(b) Dry Pendant, Flat Profile:
(1) Tyco (Grinnell): DS-C.
(2) Victaulic: V3618.
(3) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

b. Dry Pendant
1) Flat Profile:
(a) Tyco (Grinnell): DS-C.
(b) Victaulic: V3618.
(c) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

c. Dry Flexible
1) Acceptable Product
2) Victaulic VICFLEX VS1

6. Horizontal Sidewall Sprinkler:
a. Design Criteria:
1) UL / CASA listed and approved.
2) Recess adjustable.
3) Where guards are required, use chrome plated sprinkler guards that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.

b. Acceptable Products:
1) Wet System:
(a) Reliable: F1FR.
(b) Tyco (Grinnell): Model TY-FRB.
(c) Victaulic: Model V2710.
(d) Viking: VK305.
(e) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

7. Attic Sprinklers, Upright:
a. Design Criteria:
1) UL / CASA listed and approved.
2) Approved for use in roof structures, combustible and non-combustible, with ceiling below.

b. Approved Products:
1) Tyco: BB, SD, or HIP.
2) Reliable DD56, DS56, GP56
3) Viking V-BB, V-SD, V-HIP, VK697

8. Pendant Sprinklers:
a. Design Criteria:
1) UL / CASA listed and approved.

2) Where guards or escutcheons are required, use chrome plated sprinkler guards and escutcheons that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.

b. Acceptable Products:
1) Reliable: F1FR.
2) Tyco: TY-FRB.
3) Victaulic: Model V2704.
4) Viking: VK302.
5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

9. Upright Sprinklers:
a. Design Criteria:
1) UL / CASA listed and approved.
b. Acceptable Products:
1) Reliable: F1FR.
2) Tyco: TY-FRB.
3) Victaulic: Models V2704.
4) Viking: VK300.
5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

10. Water Flow Alarm:
a. Electric Flow Alarm:
1) Design Criteria:
(a) UL / CASA listed and approved.
2) Approved Products:
(a) Bell Type:
(b) Potter Electric: Bell, PBA-AC, 6 inch (150 mm) diameter, 120VAC.
(c) System Sensor: Bell, SSV-120, 120VAC.
(d) Horne Strobe Type:
(e) Potter Electric: Horn Strobe, SASH-120, 120VAC.
(f) System Sensor: Horn Strobe, P2RHK-120, 120 VAC.
3) Mechanical Flow Alarm: Water Gong.
(a) Design Criteria:
(b) UL / CASA listed and approved.
(c) Approved Products:
(d) Reliable: C.
(e) System Sensor: SSV 120 or SSM 24 Series.
(f) Tyco: WMA-1.
(g) Victaulic: Series 760.
(h) Viking: F-2.

11. Concealed Spaces Sprinkler heads
a. Design Criteria:
1) UL / CASA listed and approved.
b. Acceptable Products:
1) Viking VK950
2) Other sprinklers listed in other sections can be used if it meets their listing.

12. Pressure Gauges:
a. Mechanical Water Pressure Gauges:
b. Design Criteria:
c. UL / CASA listed and approved.
d. 3-1/2 inch (89 mm) diameter dial.
e. 0 to 300 psi (0 to 2.07 MPa) in 5 psi (34.5 kPA) increments.
f. Approved Products:

1) Reliable: UA.
2) HO Trerice: 500.
3) Viking: 01124A.

13. Waterflow Detectors:
    a. Electrical Water Flow Switch:
        1) Design Criteria:
            (a) UL / CASA listed.
            (b) Switch activates with flow of 10 gpm (37.85 lpm) or more.
            (c) Two single pole double throw switches.
            (d) Automatic reset.
        2) Approved Products:
            (a) Potter-Roemer: Model 6201 thru 6208.
            (b) System Sensor: WFD20 thru WFD80.
            (c) Viking: VSR-F.
14. Tamper Switch
    a. Weather and Tamper Resistant Switch.
        1) Design Criteria:
            (a) UL / CASA listed.
            (b) Mount to monitor valve and not interfere with operation.
            (c) Shall operate in horizontal and vertical position.
        2) Approved Products.
            (a) Control Valves, Butterfly Valves, Post Indicator Valves:
                (1) Potter Electric: Model PCVS.
                (2) Notifier: Model PIBV2.
                (3) System Sensor: Model PIBV2.
            (b) O.S. & Y Valves:
                (1) Potter Electric: Model OSYSU.
                (2) System sensor: Model OSY2.
15. Electric Flow Alarm:
    a. Design Criteria:
        1) UL / CASA listed and approved.
    b. Approved Products:
        1) Include following paragraph for Bell.
        2) Potter Electric: Bell, PBA-AC, 6 inch (150 mm) diameter, 120VAC.
        3) System Sensor: Bell, SSV-120, 120VAC.
        4) Include following paragraph for Horn Strobe.
            (a) Potter Electric: Horn Strobe, SASH-120, 120VAC.
            (b) System Sensor: Horn Strobe, P2RHK-120, 120 VAC.
16. Mechanical Flow Alarm: Water Gong. - **ONLY USE if AHJ requires**
    a. Design Criteria:
        1) UL / CASA listed and approved.
    b. Approved Products:
        1) Reliable: C.
        2) System Sensor: SSV 120 or SSM 24 Series.
        3) Tyco: WMA-1.
        4) Victaulic: Series 760.
        5) Viking: F-2.
17. Automatic Drain Device:
    a. Design Criteria:
        1) Straight Design, 3/4 inch (19 mm).
    b. Approved Products:
        1) Nibco: Ball-Drip.
        2) Potter-Roemer: Figure 5982.

18. Fire Department Connection: Do not use bare brass due to theft issues
    a. Two-way Inlet with single clapper:
        1) Quality Standards: See Section 01 6000:
            (a) Round 'AUTO SPKR' identification plate, red enamel finish aluminum plate:
                (1) Croker: Fig 6766.
                (2) Potter-Roemer Fig. 5966.
        2) Approved Products.
            (a) Rough chrome plated:
                (1) Croker: 6405-RC.
                (2) Potter-Roemer: Fig. 5710-C.
            (b) Caps and Chains:
                (1) Croker: 6747 RC.
                (2) Potter-Roemer: 4625.
19. Indicating Post Valve:
    a. Design Criteria:
        1) As specified in Section 33 1416 Site Water Utility Distribution Piping
        2) Prefer exposed parts non-brass, for theft protection.
        3) Supervisory switch.
    b. Approved Products:
        1) As required by Authority Having Jurisdiction (AHJ).
20. Riser Manifold Assembly:
    a. Design Criteria:
        1) Groove x Groove Manifold Body.
        2) Water Flow Alarm Switch, VSC with Vane, UL / CASA listed and approved.
        3) 300 psi (2.07 MPa) Water Pressure Gauge.
        4) Test and Drain Valve with Manifold Drain Trim and 1/2 inch (12.7 mm) diameter test Orifice.
        5) Pressure Relief Valve, 175 psi (1.21 MPa), non-adjustable, pipe discharge to test Drain Valve.
        6) Approved Products:
            (a) Tyco: Model 513.
            (b) Victaulic: Style 747P.
            (c) Victaulic: Style 747.

## 2.02 ACCESSORIES

A. Manufacturers:
    1. Manufacturer Contact List:
        a. Anvil International, Portsmouth, NH www.anvilintl.com.
        b. Eaton, Highland, IL www.cooperbline.com.
        c. Unistrut Construction, Itasca, IL www.unistrutconstruction.com.
    2. Continuous Inserts:
        a. Quality Standard: See Section 01 6000.
            1) Unistrut Standard Duty P-3249 through P-3270.

B. Hangers, Rods, And Clamps:
    1. Design Criteria:
        a. Galvanized, unless specified otherwise, and UL/CASA listed and labeled for service intended.
        b. Hanger supports for sprinkler piping to conformance with NFPA 13.
    2. Quality Standard:
        a. Hangers and accessories shall be Anvil numbers specified or equals by B-Line by Eaton.
        b. Pipe Ring Hangers: Equal to Anvil Fig 69.
        c. Riser Clamps: Equal to Anvil Fig. 261.

C. Posted System Diagram:
   1. Provide single floor plan diagram showing wet pipe system elements.
   2. Include following information on diagram sheet:
      a. Step by step shut down procedure.
      b. Step by step system drainage procedure.
      c. Step by step start-up procedure.
      d. Step by step procedure for protection of system from freezing.
      e. Step by step procedure to follow in deactivating system for maintenance.
   3. Laminate diagram with plastic and mat or frame suitable for hanging near riser.

**PART 3 EXECUTION**

**3.01 INSTALLERS - (SELECT ONE OF THE FOLLOWING THREE OPTIONS)**

A. Approved Installers. See Section 01 4000:
   1. Mechanical Subcontractor Contact Information:
      a. [____].
      b. [____].
      c. [____].

B. Approved Installers. See Section 01 4000:
   1. Approved Mechanical Subcontractors shall be pre-approved in accordance with Supplementary Conditions and included in Construction Documents by Addendum.

C. Approved Installers. See Section 01 4000:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

**3.02 EXAMINATION**

A. Drawings:
   1. Fire Protection Drawings show general arrangement of piping. Follow as closely as actual building construction and work of other trades will permit. Install system so it drains.
   2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Fire Protection Drawings.
   3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions and to enable system to drain.

**3.03 INSTALLATION**

A. Interface With Other Work: Provide inserts for attaching hangers in concrete floor construction at time floors are placed.

B. Connect system to flange provided under Section 33 1416: Site Water Utility Distribution Piping'. After installation of riser, fill annular space between pipe and slab with flexible mastic.

C. Install sprinkler systems in accordance with requirements of latest edition of NFPA 13 and as specified below:
   1. Provide maintenance access to equipment.
   2. Conceal sprinkler lines installed in occupied areas. In Mezzanine areas, route pipe to side or underneath Mezzanine walkway. Do not impede egress from Attic.
   3. Install to enable drainage of system.
      a. Install main drain from riser according to NFPA 13.
   4. Install piping system, except for dry heads, so it will not be exposed to freezing temperatures.
   5. Do not use dropped, damaged, or used sprinkler heads.
   6. Install tamper switches and flow detectors where located by Fire Sprinkler Consultant.
   7. Except for Siamese connection, install automatic ball drip device in lowest point of piping to fire department connection and drain to floor drain or to exterior of building.

8. Brace and support system to meet seismic zone requirements for building site.
9. Replacing anti-freeze fluid in existing systems only:
    a. Placard: Provide tag/placard on antifreeze system main valve that indicates manufacture type and brand of antifreeze solution, concentration by volume of antifreeze solution used, and volume of antifreeze solution used in system.

D. Install sprinkler systems in accordance with requirements of latest edition of NFPA 13 and as specified below:
1. Provide maintenance access to equipment.
2. Conceal sprinkler lines installed in occupied areas. In Mezzanine areas, route pipe to side or underneath Mezzanine walkway. Do not impede egress from Mezzanine or Roof.
3. Install to enable drainage of system. Drain trapped piping in accordance with NFPA 13.
    a. Install main drain from riser.
4. Install piping system, except for dry heads, so it will not be exposed to freezing temperatures.
5. Do not use dropped, damaged, or used sprinkler heads.
6. Install tamper switches and flow detectors where located by Fire Sprinkler Consultant.
7. Install automatic ball drip device in lowest point of piping to fire department connection and drain to floor drain or to exterior of building.
8. Brace and support system to meet seismic zone requirements for building site.

E. Flush system at full design flow rate for minimum five minutes. Route water to outside of building. Protect landscaping and other exterior elements from damage during flow tests.

## 3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Field Tests:
1. Pressure Test:
    a. Hydrostatically test system to 200 psi (1.38 MPa) minimum for two (2) hours as required by 'Contractor's Material And Testing certificate for Aboveground Piping':
        1) NFPA 13 (2010), Figure 24.1.
        2) NFPA 13 (2013), Figure 25.1.
        3) NFPA 13 (2016), Figure 25.1.
2. Water Flow Test:
    a. Test to determine static and residual pressures and corresponding flow rate at point of connection to utility water main.
    b. Adjust water flow test data for seasonal fluctuations and future growth as recommended by Water Utility and AHJ.
    c. At point of connection to utility water main, combine inside and outside hose stream allowances.
    d. Flush system
3. Check piping in relation to insulation envelope to be certain piping and auxiliary drains are properly enclosed inside building insulation envelope. Report unsatisfactory conditions to Fire Sprinkler Consultant.
4. Check piping in relation to building’s thermal envelope to be certain piping is within insulation envelope and protected from freezing temperatures. Report unsatisfactory conditions to Fire Sprinkler Consultant.
5. Tests shall be witnessed by Fire Sprinkler Consultant and representative of local jurisdiction over fire prevention.

## 3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Instruction of Owner:
1. Instruction Sessions:

a. Instruct Owner's personnel in operation and maintenance of system utilizing ‘Operation And Maintenance Manual’ when so doing. Minimum instruction period shall be four (4) hours.
b. Instruction sessions shall occur after Substantial Completion inspection when system is properly working and before final payment is made.
c. Provide Owner with latest version of NFPA 25.

C. Training:
1. Installer required to provide FM Training from latest version of NFPA 25 with checklist and brief explanation of following inspections:
a. Weekly Inspection.
b. Monthly Inspection.
c. Quarterly Inspection.
d. Semi-Annual Inspection.
e. Annual Inspection.

**END OF SECTION**

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**SECTION 22 0501**
**COMMON WORK RESULTS FOR PLUMBING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Common requirements and procedures for plumbing systems.
   2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
   3. Furnish and install sealants relating to installation of systems installed under this Division.

B. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, supports, and equipment for plumbing systems installed under other Sections.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Exterior concrete pads and bases for mechanical equipment.

B. Section 05 5000 - Metal Fabrications: Quality and requirements for welding.

C. Section 07 9200 - Joint Sealants: Elastomeric Joint Sealant: Quality at building exterior.

D. Sections 09 9113 - Exterior Painting: Painting of plumbing items requiring field painting.

E. Sections 09 9123 - Interior Painting: Painting of plumbing items requiring field painting.

F. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

G. Division 26: 'Electrical' for raceway and conduit, unless specified otherwise, and line voltage wiring.

H. Division 33: 'Utilities' for piped utilities.

I. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

### 1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. FM (AG) - FM Approval Guide current edition.

C. ITS (DIR) - Directory of Listed Products Current Edition.

D. NEMA MG 1 - Motors and Generators 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory Current Edition.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of domestic water, sanitary sewer, natural gas, and storm drain (where required) with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

### 1.05 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.

1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
2) Include name, address, and phone number of each supplier.

b. Informational Submittals:
1) Design Submittals:
(a) See individual specification sections in Division 22 for Submittals required.
2) Qualification Statement:
(a) Plumbing Subcontractor:
(1) Provide Qualification documentation if requested by Architect or Owner.
(b) Installer:
(1) Provide Qualification documentation if requested by Architect or Owner.

B. Shop Drawings: Indicate the locations of all hangers, supports, sleeves, and accessories.

C. Certificate: Certify that products of this section meet or exceed specified requirements.

D. Test Reports: Indicate balancing reports for domestic hot water recirculation system. Indicate the leaving water temperature at each mixing valve.

E. Evaluation Service Reports: Show compliance with specified requirements.

F. Designer's Qualification Statement.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Project Record Documents: Record actual locations of all installed piping and plumbing equipment.

## 1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Perform work in accordance with applicable provisions of Plumbing Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
3. Identification:
a. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

B. Qualifications: Requirements of Section 01 4000 - Quality Requirements apply, but not limited to the following:
1. Plumbing Subcontractor:
a. Company specializing in performing work of this section.
1) Minimum five (5) years experience in plumbing installations.
2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
b. Upon request, submit documentation.
2. Installer:
a. Licensed for area of Project.

b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
c. Upon request, submit documentation.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

F. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
1. Accept valves on site in shipping containers with labeling in place.
2. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage and Handling Requirements:
1. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by Architect until installed.
2. Store items subject to moisture damage in dry, heated spaces.

### 1.08 WARRANTY

A. Manufacturer Warranty:
1. Provide certificates of warranty for each piece of equipment made out in favor of the Owner.

B. Special Warranty:
1. Guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
2. If plumbing sub-contractor with offices located more than 150 miles from Project site is used, provide service / warranty work agreement for warranty period with local plumbing sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

## PART 2 PRODUCTS

### 2.01 COMPONENTS

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

B. Pipe and Pipe Fittings:
1. Weld-O-Let and Screw-O-Let fittings are acceptable.

C. Sleeves:
1. General:
a. Two sizes larger than bare pipe or insulation on insulated pipe.
2. In Concrete and Masonry:
a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 gage galvanized sheet metal.

D. Valves:
1. Valves of same type shall be of same manufacturer.

## PART 3 EXECUTION

## 3.01 INSTALLERS

A. Acceptable Installers:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

B. Substitution Limitations: Same as specified for products; see Section 01 6000 - Product Requirements.

## 3.02 INSTALLERS

A. Approved Installers. See Section 01 4000 - Quality Requirements:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

## 3.03 EXAMINATION

A. Drawings:
   1. Plumbing Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
   2. Mechanical Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
   3. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing Drawings.
   4. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification of Conditions:
   1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which plumbing work is dependent for efficiency and report work that requires correction.
   2. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
   3. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.
   4. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

## 3.04 PREPARATION

A. Changes Due to Equipment Selection:
   1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.
   2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
   3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
   4. Be responsible for proper location of rough-in and connections provided under other Divisions.

## 3.05 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Interface With Other Work:
   1. Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
   2. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and confirm that they are properly installed.
   3. Furnish inserts for attaching hangers that are to be cast in concrete floor construction to Division 03 at time floors are poured.

C. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

D. Locating Equipment:
   1. Arrange pipes and equipment to permit ready access to valves, cocks, unions, traps, and to clear openings of doors and access panels.
   2. Adjust locations of pipes, equipment, and fixtures to accommodate work to interferences anticipated and encountered.
   3. Install plumbing work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
   4. Determine exact route and location of each pipe before fabrication.
      a. Right-Of-Way:
         1) Lines that pitch shall have right-of-way over those that do not pitch. For example, plumbing drains shall normally have right-of-way.
         2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
      b. Offsets, Transitions, and Changes in Direction:
         1) Make offsets, transitions, and changes in direction in pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
         2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

E. Penetration Firestops:
   1. Install Penetration Firestop System appropriate for penetration at plumbing systems penetrations through walls, ceilings, roofs, and top plates of walls.

F. Sealants:
   1. Seal openings through building exterior caused by penetrations of elements of plumbing systems.
   2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

G. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus:
   1. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper installation of plumbing systems.
   2. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings:
      a. Arrange so as to facilitate removal of tube bundles.
      b. Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
         1) Make connections of dissimilar metals with di-electric unions.
         2) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.

c. Do not use reducing bushings, bull head tees, close nipples, or running couplings. Street elbows are allowed only on potable water pipe 3/4 inch in diameter and smaller.
d. Install piping systems so they may be easily drained.
e. Install piping to insure noiseless circulation.
f. Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
g. Do not install piping in shear walls.
h. Cut piping accurately to measurements established at site. Remove burr and cutting slag from pipes.
i. Work piping into place without springing or forcing.
j. Make changes in direction with proper fittings.

3. Expansion of Thermoplastic Pipe:
a. Provide for expansion in every 30 feet of straight run.
b. Provide 12 inch offset below roof line in each vent line penetrating roof.

4. Expansion of PEX Pipe: Allow for expansion and contraction of PEX pipe as recommended by Pipe Manufacturer.

H. Sleeves:
1. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete slabs on grade.
2. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Seal sleeves with specified sealants. Follow Pipe Manufacturer's recommendations for PEX pipe penetrations through studs and floor slabs.
3. Sleeves through floors shall extend 1/4 inch (6 mm) above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
4. Sleeves through floors and foundation walls shall be watertight.

I. Escutcheons:
1. Provide spring clamp plates where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.

## 3.06 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
2. Surface finishes shall exactly match existing finishes of same materials.

## 3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Field Tests:
1. Perform tests on HVAC piping systems. Furnish devices required for testing purposes.

C. Non-Conforming Work:
1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
2. Repeat tests on new material, if requested.

## 3.08 CLEANING

A. Remove dirt, grease, and other foreign matter from each length of piping before installation:
1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.

2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

B. Clean exposed piping, equipment, and fixtures. Remove stickers from fixtures and adjust flush valves.

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

## 3.09 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Instruction of Owner:
1. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.
2. Instruct building maintenance personnel and Facility Manager in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.
3. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.
4. Demonstrate proper operation of equipment to Owner's designated representative.
5. Demonstration: Demonstrate operation of system to Owner's personnel.
   a. Use operation and maintenance data as reference during demonstration.
   b. Conduct walking tour of project.
   c. Briefly describe function, operation, and maintenance of each component.
6. Training: Train Owner's personnel on operation and maintenance of system.
   a. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   b. Provide minimum of two hours of training.
   c. Instructor: Manufacturer's training personnel.
   d. Location: At project site.

## 3.10 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials. Protect plastic pipe from exposure to sunlight as appropriate.

**END OF SECTION**

## SECTION 22 0529
## HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 5000 - Metal Fabrications.

C. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

### 1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.

G. MFMA-4 - Metal Framing Standards Publication 2004.

H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
   1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

D. Derating Calculations for Fiberglass Strut Channel Framing Systems: Indicate load ratings adjusted for applicable service conditions.

E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

F. Installer's Qualifications: Include evidence of compliance with specified requirements.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

## 1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

# PART 2 PRODUCTS

## 2.01 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Materials for Metal Fabricated Supports: Comply with Section 05 5000.
   1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
   2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

D. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

## 2.02 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with MSS SP-58.
   2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be

supported with a minimum safety factor of 4. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: Comply with Section 05 5000.

C. Metal Channel (Strut) Framing Systems:
1. Manufacturers:
    a. Anvil International: www.anvilintl.com.
    b. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    c. Thomas & Betts Corporation: www.tnb.com/#sle.
    d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
    e. Substitutions: See Section 01 6000 - Product Requirements.
    f. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
3. Comply with MFMA-4.
4. Channel Material:
    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

D. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Manufacturers:
    a. Enduro Composites: www.endurocomposites.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.
    c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Channel Material: Use polyester resin or vinyl ester resin.
3. Minimum Channel Dimensions: 1-5/8 inch width by 1 inch height.
4. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2 inch diameter.
    b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
    c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
    d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

F. Thermal Insulated Pipe Supports:
1. Manufacturers:

a. KB Enterprises: www.snappitz.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

2. General Construction and Requirements:
   a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
   d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
3. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Minimum Service Temperature: Minus 40 degrees F.
   c. Maximum Service Temperature: 180 degrees F.
   d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
   e. Thickness: 60 mil.
   f. Connections: Brush on welding adhesive.
4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
   b. Erico International Corporation, a brand of Pentair: www.erico.com/#sle.
   c. PHP Systems/Design: www.phpsd.com/#sle.
   d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.
2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

H. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
   a. Hilti, Inc: www.us.hilti.com/#sle.
   b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
   c. Powers Fasteners, Inc: www.powers.com/#sle.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.
2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Hilti, Inc: www.us.hilti.com/#sle.
   b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
   c. Powers Fasteners, Inc: www.powers.com/#sle.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.
3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Powder-actuated fasteners are not permitted.
    a. Where approved by Architect.
    b. Use only threaded studs; do not use pins.
13. Hammer-driven anchors and fasteners are not permitted.
    a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
    b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
14. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
    d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
15. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A. Interface With Other Work:
   1. Furnish inserts for attaching hangers that are to be cast in concrete floor construction to Division 03 at time floors are poured.

B. Piping:
   1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
      a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
      b. Supports For Horizontal Piping:
         1) Support metal piping at 96 inches (2 400 mm) on center maximum for pipe 1-1/4 inches (32 mm) or larger and 72 inches (1 800 mm) on center maximum for pipe 1-1/8 inch (29 mm) or less.
         2) Support thermoplastic pipe at 48 inches (1 200 mm) on center maximum.
         3) Support PEX pipe at 32 inches (800 mm) minimum on center.
         4) Provide support at each elbow. Install additional support as required.
      c. Supports for Vertical Piping:
         1) Place riser clamps at each floor or ceiling level.
         2) Securely support clamps by structural members, which in turn are supported directly from building structure.
         3) Provide clamps as necessary to brace pipe to wall.

d. Install supports from inserts cast into concrete floor system, including concrete joists and floor slabs. Where inserts cannot be used, provide expansion shields and support hangers from angles held in place by expansion bolts, never directly from expansion bolt itself. Provide calculations necessary to determine number of expansion bolts required to equal capacity of cast-in-place insert.
e. Attach Unistrut to structural steel roof supporting structure. Spacing and support as described above.
f. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.

2. Gas piping Identification:
   a. Apply paint identification for gas piping used with HVAC equipment as specified in Section 23 0553.

C. Install products in accordance with manufacturer's instructions.

D. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

E. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

F. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

G. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

H. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

I. Field-Welding (where approved by Architect): Comply with Section 05 5000.

J. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

K. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

L. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners according to manufacturer's recommended torque settings.

N. Remove temporary supports.

## 3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

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**SECTION 22 0553**
**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

## PART 1 GENERAL

### 1.01 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

### 1.02 REFERENCE STANDARDS

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

## PART 2 PRODUCTS

### 2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Pipe Markers: 3/4 inch diameter and higher.

### 2.02 NAMEPLATES

A. Description: Laminated piece with up to three lines of text.
   1. Letter Color: White.
   2. Letter Height: 3/16 inch.

### 2.03 STENCILS

A. Stencil Paint:
   1. One Coat Primer:
      a. 6-2 Quick Drying Latex Primer Sealer over fabric covers.
      b. 6-205 Metal Primer under dark color paint.
      c. 6-6 Metal Primer under light color paint.
   2. Finish Coats: Two coats 53 Line Acrylic Enamel.
   3. Performance Standard: Paints specified are from Pittsburgh Paint & Glass (PPG): www.pittsburghpaints.com.
   4. Acceptable Products. See Section 01 6200.
      a. Paint of equal quality from following Manufacturers may be submitted for Architect's approval before use. Maintain specified colors, shades, and contrasts.
         1) Benjamin Moore: www.benjaminmoore.com.
         2) ICI Dulux: www.dulux.com.
         3) Sherwin Williams: www.sherwin-williams.com.

### 2.04 PIPE MARKERS

A. Provide rigid vinyl or polyester, 360 degree wrap-around pipe makers.

B. Surface printed with UV ink and then thermoformed. Legend to include pipe contents and directional arrows.

C. Provide pipe markers as follows:

| Pipe Use | Abbreviation |
|---|---|
| Domestic Hot Water | HW |
| Domestic Hot Water Recirculation | HW RECIRC |
| Domestic Cold Water | CW |
| Roof Drains | RD |
| Sanitary Vent | SV |
| Relief Vent | RV |

D. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

### 2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Degrease and clean surfaces to receive identification products.

### 3.02 INSTALLATION

A. Labels:
   1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
      a. Water Heaters.
   2. Engrave following data from Equipment Schedules on Drawings onto labels:
      a. Equipment mark.
      b. Room(s) served.
      c. Panel and breaker from which unit is powered.

B. Pipe Markers:
   1. Wrap pipe marker around pipe with 0.5 inches minimum overlap. Use adhesive strip at overlap to adhere ends of marker together.
   2. Locate markers as follows:
      a. Adjacent to each item of equipment.
      b. At points of entry and exit where piping goes through wall.
      c. On each riser and junction.
      d. Every 25 feet maximum on long, continuous runs.

C. Painting:
   1. Only painted legends, directional arrows, and color bands are acceptable.
   2. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
      a. Adjacent to each item of equipment.
      b. At point of entry and exit where piping goes through wall.
      c. On each riser and junction.
      d. Every 25 feet on long continuous lines.
      e. Stenciled symbols shall be one inch high and black.

### 3.03 ATTACHMENTS

A. Schedules:
   1. Pipe identification Schedule:
      a. Apply stenciled symbols and color banding as follows. Extend color band 2 inches minimum beyond each side of stenciled symbols.

| Pipe Use | Abbreviation | Band Color |
|---|---|---|
| Domestic Cold Water | CW | Light Blue |
| Domestic Hot Water | HW | Light Green |
| Domestic Recirc Water | HW RECIRC | Medium Green |
| Roof Drains | RD | Off-White |
| Sanitary Vent | SV | Dark Gray |
| Relief Vent | RV | Light Gray |

      b. Apply stenciled symbols as follows:

| Pipe Use | Abbreviation | Direction of Flow |
|---|---|---|
| Domestic Cold Water | CW | → |
| Domestic Hot Water | HW | → |
| Domestic Recirc Water | HW Recirc | → |

**END OF SECTION**

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**SECTION 22 0719**
**PLUMBING PIPING INSULATION**

## PART 1 GENERAL

### 1.01 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9113 - Exterior Painting: Painting insulation jacket.

C. Section 09 9123 - Interior Painting: Painting insulation jacket.

D. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

### 1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

## PART 2 PRODUCTS

### 2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

### 2.02 GENERAL MANUFACTURERS LIST

A. Armacell: www.armaflex.com.

B. Childers Products Co: www.fosterproducts.com.

C. IMCOA: www.nomacokflex.com.

D. Johns-Manville: www.jm.com.

E. Knauf: www.knauffiberglass.com.

F. Manson: www.imanson.com.

G. Nomaco Inc: www.nomacokflex.com.

H. Owens-Corning: www.owenscorning.com.

I. Speedline Corp: www.speedlinepvc.com.

### 2.03 GENERAL INSULATION REQUIREMENTS

A. Insulation Thickness:

| Service Water Temperature | | Pipe Sizes | |
|---|---|---|---|
| | Up to 1-1/4 Inches | 1-1/2 to 2 Inches | Over 2 Inches |
| 170 - 180 Deg F | One Inch | 1-1/2 Inch | 2 Inches |
| 140 - 160 Deg F | 1/2 Inch | One Inch | 1-1/2 Inches |
| 45 - 130 Deg F | 1/2 Inch | 1/2 Inch | One Inch |

B. Materials:

1. Above Grade Metal Piping:
   a. Snap-on glass fiber or melamine foam pipe insulation, or heavy density pipe insulation with factory vapor jacket.

1) Performance Standards: Fiberglas ASJ by Owens-Corning.
2) Acceptable Manufacturers:
(a) Childers Products.
(b) Knauf.
(c) Manson.
(d) Owens-Corning.
(e) Johns-Manville.
(f) Equal as approved by Architect before bidding. See Section 01 6200.

b. Fitting, Valve, And Accessory Covers:
1) PVC.
2) Performance Standard: Zeston by Johns-Manville.
3) Acceptable Manufacturers:
(a) Knauf.
(b) Speedline.
(c) Johns-Manville.
(d) Equal as approved by Architect before bidding. See Section 01 6200.

2. Below Grade Metal Piping:
a. Insulation:
1) Acceptable Products.
(a) SS Tubolit by Armacell.
(b) ImcoLock by Imcoa.
(c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
1) Acceptable Products.
(a) Armacell 520.
(b) Nomaco K-Flex R-373.

3. Pex Piping, Above And Below Grade:
a. Insulation:
1) Acceptable Products.
(a) SS Tubolit by Armacell.
(b) ImcoLock by Imcoa.
(c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
1) Acceptable Products.
(a) Armacell 520.
(b) Nomaco K-Flex R-373.

4. PP-R Piping, Above And Below Grade:
a. Insulation:
1) Acceptable Products.
(a) SS Tubolit by Armacell.
(b) ImcoLock by Imcoa.
(c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
1) Acceptable Products.
(a) Armacell 520.
(b) Nomaco K-Flex R-373.

5. PVC or ABS Piping, Above And Below Grade - Facility Storm Drain:
a. Insulation:
1) 1/2 inch (13 mm) thick.
2) Acceptable Products.
(a) SS Tubolit by Armacell.
(b) ImcoLock by Imcoa.
(c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
1) Acceptable Products.
(a) Armacell 520.
(b) Nomaco K-Flex R-373.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.02 INSTALLATION

A. Above Grade Piping:
1. Apply insulation to clean, dry piping with joints tightly butted.
2. Install insulation in manner to facilitate removal for repairs. Place sections or blocks so least possible damage to insulation will result from inspection or repairs of piping or equipment.
3. Piping up to 1-1/4 Inch Diameter:
a. Adhere 'factory applied vapor barrier jacket lap' smoothly and securely at longitudinal laps with white vapor barrier adhesive.
b. Adhere 3 inch wide self-sealing butt joint strips over end joints.
4. Piping 1-1/2 Inch Diameter And Larger:
a. Use broken-joint construction in application of two-layer covering.
b. Fill cracks and depressions with insulating cement mixed to thick plastic paste.
1) Apply by hand in several layers to make up total specified thickness.
2) Final layer shall have smooth uniform finish before application of covering.
5. Fittings, Valves, And Accessories:
a. Do not apply insulation over flanged joints or victaulic couplings until piping has been brought up to operating temperature and flange bolts have been fully tightened. Insulate valves so wheel, stem, and packing nut are exposed.
b. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
c. Piping Up To 1-1/4 Inch Diameter:
1) Cover insulation with one piece fitting cover secured by stapling or taping ends to adjacent pipe covering.
2) Alternate Method:
(a) Insulate fittings, valves, and accessories with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending 2 inches onto adjacent insulation.
d. Piping 1-1/2 Inch To 2 Inches:
1) Insulate with hydraulic setting insulating cement or equal, to thickness equal to adjoining pipe insulation.
2) Apply final coat of fitting mastic over insulating cement.
e. Piping 2-1/2 Inches And Larger:
1) Insulate with segments of molded insulation securely wired in place and coated with skim coat of insulating cement.
2) Apply fitting mastic, fitting tape and finish with final coat of fitting mastic.
6. Pipe Hangers:
a. Do not allow pipes to come in contact with hangers.
b. Pipe Shield:
1) Provide schedule 40 PVC by 6 inches long at each clevis and/or Unistrut type hanger.
2) Provide 16 gage by 6 inches long galvanized shields at each pipe hanger to protect pipe insulation from crushing by clevis hanger.

3) Provide 22 gage by 6 inches long galvanized shield at each pipe hanger to protect insulation from crushing by Unistrut type hanger.

c. At Pipe Hangers:

1) Provide rigid calcium silicate insulation (100 psi compressive strength) at least 2 inches beyond shield.

7. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

B. Below Grade Piping:

1. Slip underground pipe insulation onto pipe and seal butt joints.
2. Where slip-on technique is not possible, slit insulation, apply to pipe, and seal seams and joints.

C. Install in accordance with manufacturer's instructions.

**END OF SECTION**

**SECTION 22 1005**
**PLUMBING PIPING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.
B. Domestic water piping, buried within 5 feet of building.
C. Domestic water piping, above grade.
D. Sanitary sewer and condensate piping
E. Natural gas piping, buried within 5 feet of building.
F. Natural gas piping, above grade.
G. Pipe flanges, unions, and couplings.
H. Pipe hangers and supports.
I. Ball valves.
J. Butterfly valves.
K. Pressure reducing valves.
L. Pressure relief valves.

### 1.02 SUMMARY

A. Includes But Not Limited To:
    1. Plumbing Piping:
        a. Perform excavating and backfilling required by work of this Section.
        b. Furnish and install potable water piping complete with necessary valves, connections, and accessories inside building and connect with outside utility lines 5 feet (1 50 m) from building perimeter as described in Contract Documents.
        c. Rough-in for and connect Food Preparation sinks.
    2. Facility Sanitary Sewers:
        a. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet (1.5 m) out from building where applicable.
        b. Perform excavation and backfill required by work of this Section.
    3. Facility Storm Drainage:
        a. Furnish and install complete roof drainage system as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.
B. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
C. Section 22 0553 - Identification for Plumbing Piping and Equipment.
D. Section 22 0719 - Plumbing Piping Insulation.
E. Section 22 1006 - Plumbing Piping Specialties
F. Section 23 5400 Furnaces
G. Section 31 2316 - Excavation and Trenching.
H. Section 31 2323 - Fill and Aggregate Base.

### 1.04 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing 2019.

B. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.

G. ASME B31.1 - Power Piping 2022.

H. ASME B31.9 - Building Services Piping 2020.

I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.

J. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems 2020.

K. ASSE 1017 - Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems 2009.

L. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).

M. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

N. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.

O. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

P. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

Q. ASTM B32 - Standard Specification for Solder Metal 2020.

R. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.

S. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.

T. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.

U. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.

V. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.

W. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.

X. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings 2022.

Y. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter 2022.

Z. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.

AA. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe 2021.

BB. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.

CC. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping 2020.

DD. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.

EE. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.

FF. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.

GG. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

HH. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing 2022a, with Editorial Revision.

II. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing 2022.

JJ. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

KK. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.

LL. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.

MM. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).

NN. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.

OO. AWWA C606 - Grooved and Shouldered Joints 2015.

PP. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).

QQ. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.

RR. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2020.

SS. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.

TT. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.

UU. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

VV. MSS SP-67 - Butterfly Valves 2022.

WW. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

XX. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

YY. NSF 372 - Drinking Water System Components - Lead Content 2022.

ZZ. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe 2021.

AAA. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

## 1.05 ADMINISTRATIVE REQUIREMENTS

A. Qualifications:
   1. Manufacturer Qualifications:
      a. PP-R pipe and PP-RCT pipe:
         1) Certified by NSF International.

2. Installers Qualifications:
    a. PP-R pipe and PP-RCT pipe:
        1) Certified by Manufacturer.
3. Pre-Installation Conference:
    a. Participate in pre-installation conference as specified in Section 03 3111.

**1.06 SUBMITTALS**

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Action Submittals:
1. Product Data:
    a. Manufacturer's Literature:
        1) PEX pipe and PEX pipe fittings.
        2) PP-R pipe and PP-R pipe fittings.
        3) PP-RCT pipe and PP-RCT pipe fittings.
2. Samples:
    a. PEX pipe and fitting.
    b. PP-R pipe and fitting
    c. PP-RCT pipe and PP-RCT fitting

C. Informational Submittals:
1. Test And Evaluation Reports:
    a. Written report of sterilization test.

D. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

E. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

F. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

G. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

H. Sustainable Design Documentation: For products meeting regulatory lead-content restrictions.

I. Project Record Documents: Record actual locations of valves.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements for additional provisions.
2. Valve Repacking Kits: One for each type and size of valve.

**1.07 QUALITY ASSURANCE**

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

**1.08 DELIVERY, STORAGE, AND HANDLING**

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## 1.09 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

# PART 2 PRODUCTS

## 2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

## 2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. ABS Pipe: ASTM F628.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

D. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

## 2.03 SANITARY SEWER AND CONDENSATE PIPING, ABOVE GRADE

A. ABS Pipe: ASTM F628.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

B. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

## 2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

B. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

C. PE Pipe: ASTM D2239.
   1. Fittings: ASTM D2609, PE.
   2. Joints: Mechanical with stainless steel clamp.

D. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. Manufacturers:
      a. Uponor, Inc: www.uponorengineering.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. PPI TR-4 Pressure Design Basis:
      a. 160 psig at maximum 73 degrees F.
      b. 100 psig at maximum 180 degrees F.
      c. 80 psig at maximum 200 degrees F.

3. Fittings: Brass and copper.
4. Fittings: Brass and engineered polymer (EP) ASTM F1960.
5. Joints: Mechanical compression fittings.
6. Joints: ASTM F1960 cold-expansion fittings.

**2.05 DOMESTIC WATER PIPING, ABOVE GRADE**

A. Copper Pipe: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.
3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
1. PPI TR-4 Pressure Design Basis:
a. 160 psig at maximum 73 degrees F.
b. 100 psig at maximum 180 degrees F.
c. 80 psig at maximum 200 degrees F.
2. Fittings: Brass and copper.
3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
4. Joints: Mechanical compression fittings.
5. Joints: ASTM F1960 cold-expansion fittings.

**2.06 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING**

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M, wrought steel welding type.
2. Joints: ASME B31.1, welded.
3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

B. Copper Tube: Listed, ASTM B88 (ASTM B88M), Type K (A), annealed.
1. Fittings: ASME B16.18 cast copper or ASME B16.22 wrought copper.
2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.
3. Mechanical Press Sealed Fittings: Double-pressed type and approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

C. Flexible Gas Piping:
1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
2. Fittings: Provided by piping system manufacturer.

**2.07 NATURAL GAS PIPING, ABOVE GRADE**

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

B. Flexible Gas Piping:
1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
2. Comply with ASTM E84.
3. Fittings: Provided by piping system manufacturer.

C. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) or L (B) annealed.
1. Fittings: ASME B16.26, cast bronze.
2. Joints: Flared.

**2.08 PIPE FLANGES, UNIONS, AND COUPLINGS**

A. Unions for Pipe Sizes 3 inch and Under:
1. Ferrous Pipe: Class 150 malleable iron threaded unions.
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes Over 1 inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606.
2. Housing Material: Provide ASTM A47/A47M malleable iron, ductile iron, or galvanized.
3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

## 2.09 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
a. Cold and Hot Pipe Sizes 6 inch and Larger: Double hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.
5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
a. Bases: High-density polypropylene.
b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
c. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
d. Attachment and Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.
4. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.
5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
4. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
5. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Floor Support for Hot Pipe Sizes to 4 inch: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.
   5. Concrete Adhesive Type Anchors: Comply with ICC-ES AC308.
   6. Other Types: As required.
   7. Manufacturers:
      a. Powers Fasteners, Inc: www.powers.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

## 2.10 BALL VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Grinnell Products: www.grinnell.com/#sle.
   3. Nibco, Inc: www.nibco.com/#sle.
   4. Uponor, Inc: www.uponorengineering.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

## 2.11 BUTTERFLY VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Crane Company: www.cranecpe.com/#sle.
   3. Grinnell Products; B302: www.grinnell.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction 1-1/2 inch and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

## 2.12 PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Cla-Val Company: www.cla-val.com/#sle.
   4. Flomatic Valves: www.flomatic.com/#sle.
   5. Watts Regulator Company: www.wattsregulator.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. 2 inch and Smaller:
   1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
   2. Pressure Reducing Pilot-Operator:
      a. Operating Range: 5 to 50 psi.
      b. Connected into brass or bronze pilot piping and fittings.
      c. Fixed flow restrictor, pressure gauges, and isolation valves.

C. 2 inch and Larger:
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2. Pressure Reducing Pilot-Operator:
    a. Operating Range: 5 to 50 psi.
    b. Connected into brass or bronze pilot piping and fittings.
    c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

**2.13 MIXING VALVES**

A. Solid brass construction and CSA B125 certified.

B. Includes integral check valves and inlet screen. Features advanced paraffin-based actuation technology.

C. Flow of 5.7 GPM (21.58 LPM) with maximum 10 psi (69 kPA) pressure drop. Perform to minimum flow of 0.5 GPM (1.89 LPM) in accordance with ASSE 1070.

D. Set for 110 deg F (43 deg C) Service.

E. Match Construction Drawings for connection sizes.

F. Quality Standard: Powers LFLM495.
1. Acceptable Manufacturers: Acorn, Chicago Faucets, Leonard, Powers, Sloan, Symmons and Watts.

G. Font
1. Solid brass construction and CSA B125 certified.
2. Includes integral check valves and inlet screen. Features advanced paraffin-based actuation technology.
3. Flow of 11 GPM (41.58 LPM) with maximum 10 psi (69 kPA) pressure drop. Perform to minimum flow of 0.5 GPM (1.89 LPM) in accordance with ASSE 1017.
4. Set for 100 deg F (38 deg C) Font Service.
5. Match Construction Drawings for connection sizes.
6. Quality Standard: Watts LFMM431.
    a. Acceptable Manufacturers: Acorn, Leonard, Powers, Sloan, Symmons, and Watts.

**2.14 CIRCUIT BALANCING VALVES:**

A. Valves 3/4 inch through 6 inches (19 mm through 150 mm):
1. Four function capability: Flow measurement, flow balancing with memory stop, positive shut off, and drain.
2. Provide provisions for connecting differential pressure meter. Each meter connection shall have shut off valves.
3. Include tamper proof and memory features.
4. Approved Products.
    a. Armstrong: CBV.
    b. Bell & Gosssett: Circuit Setter.
    c. Taco: Accu-Flo.

**2.15 PRESSURE RELIEF VALVES**

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

**2.16 STRAINERS**

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com/#sle.
2. Green Country Filter Manufacturing: www.greencountryfilter.com/#sle.
3. WEAMCO: www.weamco.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Domestic water use must meet NSF requirements

C. Size 2 inch and Smaller:

1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

D. Size 1-1/2 inch to 4 inch:
1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

### 3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Follow all manufacturers requirements.

### 3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
1. See Section 22 0719.

H. Provide access where valves and fittings are not exposed.
1. Coordinate size and location of access doors with Section 08 3100.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.

L. Excavate in accordance with Section 31 2316.

M. Backfill in accordance with Section 31 2323.

N. Install bell and spigot pipe with bell end upstream.

O. Install valves with stems upright or horizontal, not inverted. See Section 22 0523.

P. Install water piping to ASME B31.9.

Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

R. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

S. Pipe Hangers and Supports:

### 3.04 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

### 3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.
   1. Prior to starting work, verify system is complete, flushed, and clean.
   2. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
   3. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
   4. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
   5. Maintain disinfectant in system for 24 hours.
   6. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
   7. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
   8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### 3.06 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved double check backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer. These may be located inside the building
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18 gauge, 0.0478-inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

### 3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inch to 1-1/4 inch:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inch to 2 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inch to 3 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 1/2 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger Rod Diameter: 3/8 inch.

### 3.08 WARRANTY

A. 10 years factory-certified minimum for
   1. PP-R pipe and fittings
   2. PP-RCT pipe and PP-RCT fittings

**END OF SECTION**

**SECTION 22 1006**
**PLUMBING PIPING SPECIALTIES**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install miscellaneous potable water piping specialties as described in Contract Documents.
   2. Products furnished but not installed under this section as described in Contract Documents.

### 1.02 RELATED REQUIREMENTS

A. Section 22 0501 - Common Work Results for Plumbing.

B. Section 22 1005 - Plumbing Piping.

C. Section 22 3000 - Plumbing Equipment.

D. Section 22 4000 - Plumbing Fixtures.

### 1.03 REFERENCE STANDARDS

A. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2022.

B. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.

C. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent 2021.

D. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies 2021.

E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).

F. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

G. NSF 372 - Drinking Water System Components - Lead Content 2022.

H. PDI-WH 201 - Water Hammer Arresters 2017.

### 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Certificates: Certify that grease interceptors meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

H. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Extra Loose Keys for Outside Hose Bibbs: One.
   3. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

### 2.02 GENERAL MANUFACTURERS

A. Ashcroft; www.ashcroftinc.com.

B. H O Trerice; www.hotco.com.

C. IPS Corporation; www.ipscorp.com.

D. Josam Co; www.josam.com.

E. Jay R. Smith Manufacturing Co; www.jrsmith.com.

F. Prier Products, Inc; www.prier.com.

G. Proset Systems Inc; www.prosetsystems.com.

H. Sioux Chief Manufacturing Co; www.siouxchief.com.

I. Sure Seal; www.thesureseal.com.

J. Wade (Division of Tyler Pipe); www.wadedrains.com.

K. Watts Drainage; www.watts.com.

L. Weiss Instruments, Inc; www.weissinstruments.com.

M. Woodford Manufacturing; www.woodfordmfg.com.

N. Zurn Cast Metals; www.zurn.com.

### 2.03 TRAP GUARD TRAP SEAL

A. Design Criteria:
   1. Not required to meet NSF International Standards for Lead Free.

B. Approved Products.
   1. Trap Guard by Proset:
      a. Install per Manufacturer’s recommendations.
   2. Sure Seal by Sure Seal:
      a. Install per Manufacturer's recommendation.

### 2.04 DRAINS

A. Floor Drain (FD-1):
   1. Approved types with deep seal trap and chrome plated strainer.
   2. Approved Products.
      a. Josam: 30000-50-Z-5A.
      b. J. R. Smith: 2010-A.
      c. Mifab: F-1100-C.
      d. Sioux Chief: 832.
      e. Wade: 1100.
      f. Watts: FD-200-A.
      g. Zurn: Z-415.

### 2.05 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas (COTG):
1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas (COTG):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas (FCO):
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas (WCO):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas (WCO): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

## 2.06 HOSE BIBBS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.
3. Watts Regulator Company: www.wattsregulator.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Hose Bibbs:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome-plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

## 2.07 HYDRANTS

A. Manufacturers:
1. Arrowhead Brass & Plumbing, LLC: www.arrowheadbrass.com/#sle.
2. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
3. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Hydrants (HB-1):
1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker. Locking. Minimum 12 inches - meet or exceed design conditions

## 2.08 BACKWATER VALVES

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Savko Plastic Pipe & Fittings, Inc: www.savko.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Cast Iron Backwater Valves: ASME A112.6.4; lacquered cast iron body and cover, brass valve, extension sleeve, and access cover.

C. Plastic Backwater Valves: ABS body and valve, extension sleeve, and access cover.

## 2.09 BACKFLOW PREVENTERS

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.

2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC; 375XL: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Reduced Pressure Backflow Preventer Assembly:
1. ASSE 1013; cast bronze body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.
2. Size: 2 inch assembly with threaded gate valves.

## 2.10 DOUBLE CHECK-VALVE ASSEMBLIES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC; 350AST: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Double Check Valve Assembly:
1. ASSE 1012; cast bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.

## 2.11 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

## 2.12 ACCESSORIES

A. Drain Accessories:
1. Condensate Receptor (CR):
a. Approved Products.
1) Trap seal by Sureseal. Provide model number to match condensate receptor .
2) Trap guard by Proset Systems. Provide model number to match condensate Receptor
2. Floor Drains (FD-1~2):
a. Approved Products.
1) Trap guard by Proset Systems. Provide model number to match floor drain.
2) Trap seal by Sureseal. Provide model number to match floor drain.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

**END OF SECTION**

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**SECTION 22 3000**
**PLUMBING EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Condensing gas-fired water heaters.

B. Tankless gas-fired water heaters.

C. Tankless electric water heaters.

### 1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install gas-fired tankless water heaters as described in Contract Documents.
   2. Furnish and install gas-fired tank water heaters as described in Contract Documents.
   3. Furnish and install electric tankless water heaters as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. Section 22 0501 - Common Work Results for Plumbing.

B. Section 23 1123 - Facility Natural-Gas Piping.

C. Section on 23 5400 Furnaces [Air Piping]

D. Section 22 1005 - Plumbing Piping.

E. Section 01 4543 Font Water Adjusting and Balancing

### 1.04 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.

B. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less 2019, with Errata (2020).

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 174 - Standard for Household Electric Storage Tank Water Heaters Current Edition, Including All Revisions.

### 1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

### 1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate heat exchanger dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Project Record Documents: Record actual locations of components.

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Project Record Documents: Record actual locations of components.

H. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance and operational instructions.
         2) Warranty Documentation:
            (a) Final, executed copy of Warranty.
         3) Record Documentation:
            (a) Manufacturers documentation:
               (1) Manufacturer's literature or cut sheet.

## 1.07 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come in contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
   2. Seismic Anchoring System:
      a. Required for Seismic Design Category (SDC) C, D, E, or F or where authority having jurisdiction (AHJ) requires seismic protection use for water heater seismic anchoring systems.
      b. Seismic Design Category (SDC) shall be determined by Project Structural Engineer.
      c. Anchoring Components:
         1) Seismic certified/approved and labeled:
            (a) Straps/anchoring systems.
            (b) Fasteners.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

C. Certifications:
   1. Water Heaters: NSF approved.
   2. Gas Water Heaters: AHRI Directory of Certified Product Performance.
   3. Electric Water Heaters: UL listed and labeled to UL 174.
   4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

D. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

E. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

## 1.08 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

## 1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

C. Provide Manufacture standard warranty from date of Substantial Completion covering both tank and component parts for leakage or other malfunction caused by defects in materials and/or workmanship.

D. Special Warranty:
   1. Three-year non-prorated warranty on water heaters of 20-gallon (76-liter) capacity and larger.
   2. Direct Vent Water Heater:
      a. 10-year factory warranty on heat exchanger and 3 years on other parts.

## PART 2 PRODUCTS

### 2.01 WATER HEATERS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. ACT, Inc, Costa Mesa CA, (800) 200-1956
      b. American Water Heater Co; www.americanwaterheater.com.
      c. A. O. Smith Water Products Co; www.hotwater.com; (800) 265-8520 or (519) 271-5800.
      d. Enovative Group; www.enovativegroup.com.
      e. Bradford-White Corp; www.bradfordwhite.com.
      f. Heat Transfer Products; www.htproducts.com.
      g. Lochinvar; www.lochinvar.com.
      h. Rheem / Ruud Water Heater Div Rheem Manufacturing; www.rheem.com; (800) 268-6966 or (905) 527-9194.
      i. State Industries Inc; www.stateind.com.

B. Condensing Gas-Fired Tank Type Water Heaters (WH-1):
   1. Stainless steel or 90/10 cupronickel heat exchanger, pressure tested and rated for 150 psi w.p. complete with thermostat, high limit control, gas pressure regulator, 100 percent safety shutoff and powered combustion air blower. AGA and CGA approved.
   2. Minimum 94 percent thermal efficiency,
   3. Temperature and pressure relief valve sized to match heat input and set to relieve at 120 psi (0.83 MPa).
   4. Vacuum relief valve meeting requirements of CSA ANSI Z21.22.
   5. 30 - 65 Gallon (113 - 246 Liter):
      a. Approved Products:
         1) Polaris Model PGC3 34-130-2NV by American (34 gallons).
         2) Polaris PGC3 50-130-3NV by American (50 gallons).
         3) Cyclone BTX-100 by A. O. Smith (50 gallon).
         4) EF-60T-125E-3N by Bradford White (60 gallon).
         5) Phoenix PH100-55 by Heat Transfer Products (55 gallons).
         6) RGH-100 by Heat Transfer Products (30 gallon).
         7) SNR126-065 by Lochinvan (65 Gallon).
         8) HE45-100 by Rheem (45 gallons).
         9) Force 90+ SHE50 100NE by State Industries (50 gallons).
   6. Accessories:
      a. Anchoring Components:
         1) Seismic certified/approved and labeled.
            (a) One inch by 18 ga (25 by 1.2 mm) galvanized steel straps.
            (b) No. 10 by 2-1/2 inch (64 mm) screws.
      b. Recirculation Pump and Circulation Pump Control:
         1) Hot water demand control type.
         2) Circulation Pump (CP-1).
         3) Controller with temperature sensor.
         4) Hard-Wired Motion Sensors.

5) Hard-Wired Manual Activation Button.
6) Acceptable Products:
(a) RO150A AutoHot Controller with 150 series pump, temperature sensor, and push button activator by Enovative Group. Include HM-S-17A hard wired motion sensors.
(b) SS3-200 with pump, temperature sensor, control box, and hard-wired button by ACT, Inc. Include HWMSRB-O hard wired motion sensors.
(c) Equal as approved by Architect before bidding. See Section 01 6200.

c. Thermal Expansion Absorbers:
1) Bladder type for use with potable water systems.
2) Type One Acceptable Products:
(a) Therm-X-Trol ST-12 by Amtrol Inc; www.amtrol.com.
(b) Equal as approved by Architect before bidding. See Section 01 6200.

C. Instantaneous, Tankless, Gas Domestic Water Heaters (WH-2):
1. Manufactured Units:
a. Design Criteria:
1) All (wetted) drinking water products, components, and materials used in drinking water systems must meet NSF International Standards for Lead Free.
b. Direct Vent:
1) Include vent package and direct vent termination kit for complete vent installation.
2) All domestic water wetted components must be Lead Free and certified to NSF Lead Free standards.
3) Approved Products. See Section 01 6200 for definition of Categories.
c. Meetinghouse with Font:
1) Approved Products:
(a) Model RTC-199 by HTP, Inc; www.htproducts.com:
(1) Attn: Michael Lundquist; 801-487-5700; ml@lundquistsales.com.
(b) NPE 240A (Pb) or NPE 240S by Navien; www.NavienAmerica.com:
(1) Attn: Holly Stubbs at McGregor & Associates; 801-860-4997 or holly@mcgregor-assoc.com.
(c) Model NCC199CDV or EZ111DV by Noritz, distributed by Franklin James Company:
(1) Attn: Mark Evans, cell (801) 558-3142; mark@franklinjames.com.
(d) Model RU 199i by Rinnai; www.rinnai.us:
(1) Attn: Colin Schmidt at MJM Associates Inc; (801) 631-6794; cschmidt@mjmassoc.com.
(e) Model T-H3-DV by Takagi; www.takagi.com.
2. Type: Automatic, natural gas-fired, instantaneous.
3. Performance:
a. Maximum Working Pressure: 150 psig.
b. Certification: CSA P.3.
4. Controls: Automatic water thermostat and built-in gas pressure regulator; temperature range adjustable from 120 to 170 degrees F, safety pilot and thermocouple.
5. Accessories:
a. Water Connections:
b. Dip Tube: Brass.
c. Drain valve.
d. PVC Flue Piping (Instantaneous Tankless Water Heaters):
1) Manufacturer Contact List:
(a) Armaflex by Armacell; www.armaflex.com.
(b) Nomaco; www.nomacokflex.com.
2) Flue:

(a) Air Piping: Schedule 40 pipe [solid core only] and fittings meeting requirements of ASTM D1785, ASTM D2661, or ASTM D2665.

3) Piping Primer And Cement.
   (a) Meet requirements of ASTM D2564.
   (b) Use PVC solvent cement that has a VOC content of 510 g/L or less if local required by local AHJ.
   (c) Use adhesive primer that has a VOC content of 550 g/IL or less if local required by local AHJ.
4) Solvent Cement and Adhesive Primer:
   (a) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   (b) Use adhesive primer that has a VOC content of 550 g/IL or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   (c) Meet requirements of ASTM F656 for cement primer and ASTM D2564 for pipe cement.
5) Flexible Foamed Pipe Insulation:
   (a) Thickness:
      (1) 1/2 inch (13 mm) for 2 through 3 inch (50 through 75 mm) outside diameter pipe.
      (2) 1/2 inch (13 mm) sheet for fittings as recommended by Manufacturer.
   (b) Approved Products.
      (1) Tubolit by Armaflex.
      (2) ImcoLock or Therma-Cel by Nomaco K-Flex.
6) Insulation Joint Sealer:
   (a) For indoor applications:
      (1) Provide adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   (b) Approved Products.
      (1) 520 by Armaflex.
      (2) R-320 by Nomaco K-Flex.

e. Stainless Steel Flues (Instantaneous Tankless Water Heaters):
   1) Manufacturer Contact List:
      (a) Double wall, factory-fabricated Category III type.
      (b) Armaflex by Armacell; www.armaflex.com.
      (c) Nomaco; www.nomacokflex.com.
   2) Flue:
      (a) Design Criteria:
         (1) Double wall, factory-fabricated Category III type.
         (2) AL-29-4C stainless steel inner conduit and Type 430 stainless steel outer jacket.
         (3) Inspection cap, condensate drain, and roof flashing. Provide horizontal, vertical, and roof support.
         (4) Seal joints as recommended by Flue Manufacturer.
      (b) Approved Products.
         (1) Saf-T Vent C1 by Heat-Fab.
         (2) Fasnseal W2 by Protech Systems.
         (3) Z-Vent III by Z-Flex (US).

D. Tankless Electric Water Heater (WH-3):
   1. Manufacturers:
      a. Chronomite, Inc: www.chronomite.com/#sle.
      b. Eemax: www.eemax.com/#sle
   2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.

3. Heater Type: Self-contained, wall-mounted unit capable of handling listed capacity, water-inlet strainer, removable thermally-insulated front panel, and threaded water pipe-end connections.
4. Heater-Heat Exchanger: Stainless steel, thermally insulated and encased assembly in corrosion-resistant steel jacket; baked-on enamel finish.
5. Safeties: Provide internal safeties for water flow, electrical load, and thermal load.
6. Controls: Color touchscreen interface for internal controls; temperature range adjustable from 120 to 170 degrees F using flanged or screw-in nichrome elements. Wire double-element units so elements do not operate simultaneously.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Install temperature-pressure relief valve on hot water heater and pipe discharge to directly above funnel of floor or condensate drain.

D. Anchor 20-gallon (76-liter) and larger water heaters to wall using anchoring straps and specified screws.

E. Water Heaters:
1. Water heaters shall each have relief valve sized to match heat input and set to relieve at 120 psi (827 kPa).
2. Install temperature-pressure relief valve on hot water heater and pipe discharge directly above funnel of floor condensate drain.
3. Provide mixing valve at all water heater installations as specified in Section 22 1005.
4. Connect to condensate drain following Section 22 1005

F. Vent:
1. Vent package and direct vent termination to be installed per Manufacturer’s recommendations.
2. PVC Flue Piping:
   a. General:
      1) Run individual vent and individual combustion intake piping from each water heater to roof termination as recommended by Water Heater Manufacturer. Concentric roof termination kit may be used if approved by and provided by Water Heater Manufacturer. Slope lines downward toward water heater.
      2) Slope combustion chamber exhaust drain downward to floor drain.
   b. Support:
      1) Support concentric roof termination kit at ceiling or roof line with 20 ga (0.95 mm) sheet metal straps as detailed on Drawings.
      2) Support horizontal sections of pipe in accordance with requirements of Section 23 0501. Anchor securely to structure, not allowing pipe to sway.
   c. Insulation:
      1) General:
         (a) Install insulation in snug contact with pipe and in accordance with Manufacturer's recommendations.
         (b) Slip insulation on piping before piping sections and fittings are assembled keeping slitting of insulation to a minimum.
         (c) Joints:
         (d) Place 'slit' joint seams of insulation exposed outside building on bottom of pipe.
         (e) Stagger joints on layered insulation.

(f) Seal joints in insulation.
(g) Paint exterior exposed insulation with two coats of finish recommended by Insulation Manufacturer, color selected by Architect.

3. Stainless Steel Flues (Instantaneous Tankless Water Heaters):
   a. General:
      1) Height of flue above roof shall be as shown on Drawings unless local code requires it be higher.
      2) Length of horizontal flues or flue connectors shall not be longer than 75 percent of height of vertical flue between point at which horizontal flue enters vertical flue to top of vertical flue. In no case shall horizontal run exceed 15 feet (4.57 m).
      3) Every portion of flue connector shall have rise of one-inch (25 mm) per 1 foot(300 mm) minimum from appliance to vertical flue.
4. Install hot water circulation pump and pump controls per manufacturer's instructions:
   a. Coordinate with Contract Drawings for location of hard-wired motion sensors.
   b. Connect hard-wired motion sensors to pump control box.
   c. Verify correct operation of hard-wired motion sensors.
   d. Install manual activation button near pump.

**3.02 ADJUSTING**

A. Set discharge water temperature at 120 deg F (49 deg C). Final hot water temperature shall be 110 deg F (43 deg C) after thermostatic mixing valve. If no mixing valve set discharge temperature at 110 deg F (43 deg C).

B. For water heater that is dedicated to the font, set discharge water temperature at 140 deg F (60 deg C). Final hot water temperature shall be 100 deg F (38 deg C) after thermostatic mixing valve. If no mixing valve set discharge temperature at 100 deg F (38 deg C).

C. Adjust gas input pressure to be between 6 and 7 inches (150 and 180 mm) of water column at regulator inlet. Adjust burner manifold pressure to 4.3 inches (110 mm) of water column on downstream side of gas regulator.

**END OF SECTION**

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**SECTION 22 4000**
**PLUMBING FIXTURES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Tank type water closets.

B. Wall hung urinals.

C. Lavatories.

D. Sinks.

E. Service sinks.

F. Handicap accessible bi-level coolers.

G. Outdoor handicap accessible bi-level drinking fountains.

### 1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install plumbing fixtures as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

### 1.04 DEFINITIONS

A. High-Efficiency Toilet (HET): Toilets with effective flush volume of 1.28 gallons (4.8 liters) or less.

B. Maximum Performance (MaP): Toilet testing that rates toilet efficiency and flush performance by measuring number of grams of solid waste (soybean paste and toilet paper) that a toilet can flush and remove completely from fixture in single flush represented as a scale or score. 1000 grams is highest score possible (www.map-testing.com). All products must meet MaP 1000 score.

### 1.05 REFERENCE STANDARDS

A. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

B. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.

C. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018, with Errata.

D. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.

E. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; 1994 (Reaffirmed 2009).

F. ASME A112.19.14 - Six-Liter Water Closets Equipped with a Dual Flushing Device; 2013 (Reaffirmed 2018).

G. NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.

H. NSF 372 - Drinking Water System Components - Lead Content; 2022.

I. UL (DIR) - Online Certifications Directory; Current Edition.

### 1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Samples: Submit two lavatory supply fittings.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Operation and Maintenance Data:
         1) Sensor Operated operation and maintenance manuals.

**1.07 QUALITY ASSURANCE**

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

**1.08 WARRANTY**

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

**2.02 REGULATORY REQUIREMENTS**

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

**2.03 GENERAL MANUFACTURERS**

A. Manufacturers:
   1. Manufacturer Contact List:
      a. American Standard Brands; www.americanstandard-us.com.
      b. AMTC - Advanced Modern Technologies Corp; www.amtcorporation.com.
      c. Bemis Manufacturing Co; www.bemismfg.com.
      d. Beneke by Sanderson Plumbing Products; www.sppi.com.
      e. Church Seat Co; www.churchseats.com.
      f. Delany Flush Valves; www.delanyproduct.com.
      g. Delta Faucet Co; www.deltafaucet.coM; (519) 659-3626.
      h. Dearborn Brass; www.dearbornbrass.com.
      i. Gerber Plumbing Fixtures LLC; www.gerberonline.com.
      j. Josam Co; www.josam.com.
      k. Jay R. Smith Mfg. Co; www.jrsmith.com.
      l. Kohler Co Plumbing Div; www.us.kohler.com.
      m. McGuire Manufacturing Co; www.mcguiremfg.com.
      n. Mifab Manufacturing Inc; www.mifab.com.
      o. Moen Incorporated; www.moen.com.
      p. Olsonite Corp; www.olsonite.net; (519) 682-1240.
      q. Sloan Valve Co; www.sloanvalve.com.
      r. South Fork Manufacturing; (801) 953-3001; www.dirt-grabber.com.
      s. Toto U.S.A., Inc; www.totousa.com
      t. Wade Div Tyler Pipe; www.wadedrains.com.

u. Watts Drainage; www.wattsdrainage.com.
v. Zurn Industries, LLC; www.zurn.com; (905) 795-8844.

## 2.04 TANK TYPE WATER CLOSETS

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Toto: www.totousa.com/#sle.
3. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
4. Kohler Company: www.kohler.com/#sle.
5. Eljer: www.eljer.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Floor-Mounted Bowl:
1. ASME A112.19.2; siphon jet, vitreous china, 16.5 inches high, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps, vandalproof cover locking device.
2. Water Consumption: 1.6 gal per flush, maximum.

C. Bowl: ASME A112.19.2; wall hung, vitreous china, reverse trap, whirlpool action close-coupled closet combination with regular rim, insulated vitreous china closet tank with fittings and lever flushing valve, chrome-plated bolt caps.

D. Floor Mounted With Tank:
1. HET (High-Efficiency Toilet) - Standard Fixture (WC-1):
a. Water usage of 1.28 gallons (4.8 liters) per flush.
b. MaP Score of 1000 grams.
c. Approved Products.
1) American Standard: Cadet 3 Elongated 215CA.004.
2) Gerber: Avalanche WS-21-812.
3) Kohler: Wellworth K-3948.
4) Toto: 'ECO Drake' CST744E or CST744EG.
2. HET (High-Efficiency Toilet) - Handicap Accessible Fixture (WC-2):
a. Water usage of 1.28 gallons (4.8 liters) per flush.
b. 18 inch (450 mm) maximum rim height.
c. MaP Score of 1000 grams.
d. Approved Products.
1) American Standard: Cadet Pro Right Height Elongated 215AA.104.
2) Gerber: Avalanche WS-21-818.
3) Kohler: Highline K-3949.
4) Toto: 'ADA Drake' CST744EL.

E. Toilet Seats:
1. Plastic: Solid, white, elongated, open front, hinged seat cover, extended back with self-sustaining hinges, and brass bolts with covers.
2. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
c. DXV by American Standard, Inc: www.dxv.com/#sle.
d. PROFLO; Camas - Slow Close, Easy Clean, Heavy Duty: www.ferguson.com/#sle.
e. Substitutions: See Section 01 6000 - Product Requirements.

F. Water Closet Carrier:
1. Manufacturers:
a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.

## 2.05 WALL HUNG URINALS

A. Manufacturers:

1. Advanced Modern Technologies Corporation: www.amtcorporation.com/#sle.
2. American Standard, Inc: www.americanstandard-us.com/#sle.
3. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
4. Kohler Company: www.kohler.com/#sle.
5. Sloan Valve Company: www.sloanvalve.com/#sle.
6. Toto USA: www.totousa.com/#sle.

B. Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Consumption Volume: 1.0 gal per flush, maximum.
2. Flush Style: Washout.
3. Flush Valve: Exposed (top spud).
4. Flush Operation: Sensor operated.
5. Trapway Outlet: Integral.
6. Removable stainless steel strainer.
7. Supply Size: 3/4 inch.
8. Outlet Size and Location: 2 inches, bottom side.

C. HEU (High-Efficiency Urinal) - Standard Fixture (U-1):
1. Water usage of 0.5 gallons (1.9 liters) per flush.
2. Approved Products.
a. American Standard: Washbrook FloWise 6590.001.
b. Gerber: Monitor 27-730.
c. Kohler: Bardon K-4991-ET.
d. Sloan SU-1009.
e. Toto: UT447E.

D. Flush Valve:
1. HEU (High-Efficiency Urinal) – Standard (U-1):
a. Proximity sensor type with battery.
1) Low flow, 0.5 gallon (1.9 liters) per flush maximum.
2) Approved Products.
(a) American Standard 6063.051.
(b) Delany: PL 1451-0.5.
(c) Delta: 81T231BTA factory set to 0.5 gallons per flush.
(d) Moen: 8315.
(e) Sloan: 8186-0.5.
(f) Zurn: ZER6003AV-EWS with maintenance override button.

E. Flush Valve Filter:
1. Required in following flush valves:
a. Sloan.
b. Zurn.
2. Approved Products.
a. SFDG1 'Dirt Grabber' by South Fork Manufacturing.

F. Urinal Carriers:
1. Manufacturers:
a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
b. JOSAM Company: www.josam.com/#sle.
c. Zurn Industries, LLC; Z1221: www.zurn.com/#sle.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

## 2.06 LAVATORIES

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. DXV by American Standard, Inc: www.dxv.com/#sle.

3. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
4. Kohler Company: www.kohler.com/#sle.
5. Zurn Industries, LLC: www.zurn.com/#sle.

B. Performance:
1. Design Criteria:
a. Interior exposed pipe, valves, and fixture trim, including trim behind custom casework doors, shall be chrome plated.
b. Faucets and other fixture fittings shall conform to requirements of ASME A112.18.1/CSA B125.1.
c. Lavatories shall conform to requirements of:
1) Enameled cast iron and enameled steel fixtures.
(a) ASME A112.19.1/CSA B45.2.
(b) CSA B45.2/ASME A112.19.1.

C. Components:
1. Lavatories And Fittings:
a. Standard and Handicap Accessible Counter Top Lavatories (L-1):
1) Size 20 by 17 inches (500 by 430 mm) nominal.
2) Approved Products.
(a) American Standard: Aqualyn 0476.028.
(b) Gerber: Luxoval 12-844.
(c) Kohler: Pennington K-2196-4N.
b. Standard and Handicap Accessible Self Supporting Lavatories (L-2):
1) Size: 20 by 18 inches (500 by 450 mm) nominal.
2) Approved Products.
(a) American Standard: Lucern 0355.012.
(b) Kohler: Greenwich K-2032.
c. Carrier / Support:
1) Approved Products.
2) Josam: 17100.
(a) Jay R. Smith: 0700.
(b) Mifab: MC-41.
(c) Wade: 520-M36.
d. Lavatory Fittings:
1) Faucet and Grid Strainer for Standard Sinks:
(a) Design Criteria:
(1) Meet NSF International Standards for Lead Free.
(b) Approved Products.
(1) American Standard: Monterrey Two-Handle Centerset Lavatory Faucet with Vandal-Resistant Wrist Blade handles and grid strainer drain 5502.170.
(2) Chicago: 802CP with 327XCP.
(3) Delta: 2529HDF.
(4) Gerber: C4-44-412.
(5) Kohler: K-7404-5A with K-7715 strainer.
(6) Moen: 8215 with 14750 grid strainer.
(7) Speakman: SC 3072.
(8) T & S: B-0890 with B-0899 Grid Strainer.
(9) Zurn: Z81104 with McGuire 155A Grid Strainer.
e. Faucet and Grid Strainer For Handicap Accessible Sinks:
1) Design Criteria:
(a) Meet NSF International Standards for Lead Free.
2) Approved Products.

(a) American Standard: Monterrey Two-Handle Centerset Lavatory Faucet with Vandal-Resistant Wrist Blade handles and grid strainer drain 5502.170.
(b) Chicago: 802-317CP with K7715 strainer.
(c) Delta: 2529HDF.
(d) Gerber: CO-44-412.
(e) Kohler: K-7404-5A with K-13885 strainer.
(f) Moen: 8215 with14750 grid strainer.
(g) Speakman: SC 3074.
(h) T & S: B-0890 with B-0899 Grid Strainer.
(i) Zurn: Z-81104 with McGuire 155A grid strainer.

f. Flow Control Fitting:
1) Design Criteria:
(a) Meet NSF International Standards for Lead Free.
2) Accessories:
(a) Provide vandal-proof type in place of aerator. Flow shall be 0.5 gpm.
3) Approved Product.
(a) Omni L-200 Series by Chronomite Laboratories.

g. Supply pipes with stops:
1) Design Criteria:
(a) Meet NSF International Standards for Lead Free.
2) Accessories:
(a) Provide chrome plated quarter-turn brass ball valve, 12 inches (305 mm) long braided stainless steel riser, and chrome-plated steel flange.
3) Approved Products.
(a) McGuire: BV2165CC.
(b) Zurn: Z8804 LRQ-PC.

h. Trap:
1) Description:
(a) 17 gauge (1.4 mm) tube 'P' trap, chrome plated.
2) Design Criteria:
(a) Not required to meet NSF International Standards for Lead Free.
3) Approved Products.
(a) Dearborn.
(b) Engineered Brass Company (EBC).
(c) Keeney Manufacturing.
(d) McGuire.
(e) Zurn.

i. Safety Covers for Handicap Accessible Lavatories:
1) Description:
(a) Provide protection on water supply pipes and on trap.
2) Design Criteria:
(a) Not required to meet NSF International Standards for Lead Free.
3) Approved Products.
(a) Trapwrap by Brocar Products Inc.
(b) Pro Wrap by McGuire Products.
(c) Lav Guard 2 by TrueBro.
(d) Pro Extreme by Plumberex.
(1) Moen: 8124.
(2) Speakman: SC-5812.
(3) T&S: B-0665-BSTP.
(4) Zurn: Z-843M1.
4) Drain and Strainer:

(a) Approved Products.
(1) American Standard: Grid strainer 7721.038.
(2) Kohler: K-9146, 3 inch IPS.
(3) Trap: Cast iron, PVC, or ABS to match piping.

**2.07 SINKS**

A. Manufacturers:
1. Acorn-Sinks: www.acorneng.com/home
2. American Standard, Inc: www.americanstandard-us.com/#sle.
3. Kohler Company: www.kohler.com/#sle.
4. Meganite, Inc: www.meganite.com/#sle.
5. Relang International, LLC; DURASEIN: www.duraseinusa.com/#sle.

B. Performance:
1. Design Criteria:
a. Interior exposed pipe, valves, and fixture trim, including trim behind custom casework doors, shall be chrome plated.
b. Faucets and other fixture fittings shall conform to requirements of ASME A112.18.1/CSA B125.1.
c. Sinks shall conform to requirements of:
1) Stainless steel plumbing fixtures:
(a) ASME A112.19.3/CSA B45.4.
(b) CSA B45.4/ASME A112.19.3.

C. Stainless Steel Sinks and Fittings:
1. Design Criteria:
a. Not required to meet NSF International Standards for Lead Free.
b. Self-rimming, 18 gauge (1.2 mm) stainless steel, satin finish.

D. Sacrament Preparation Room Single Compartment Sink (SS-2):
1. Description:
a. Size: 19 by 18 inches (483 mm by 457 mm) nominal.
2. Design Criteria:
a. Not required to meet NSF International Standards for Lead Free.
3. Approved Products.
a. Elkay: LR 1918.
b. Just: SL-2017-A-GR.
c. Kindred: LBT 2709P-1.
d. Elkay: LRAD 1918.
e. Just: DL-ADA-2017-A-GR.
f. Kindred: ALBS 270P-1.
4. Faucets for Sacrament Preparation Room Sink (SS-2):
a. Design Criteria:
1) Meet NSF International Standards for Lead Free.
b. Approved Products.
1) American Standard: Gooseneck Swivel Spout 7100.241H.
2) Chicago: 350-ABCP.
3) Delta: 27C643-R4.
4) Gerber: C4-44-701.
5) Kohler: K-7895-C.
6) Moen: 8103.
7) Speakman: SC-7112.
8) T & S: 0305-01.
9) Zurn: Z-825B1FC.

E. Serving Area Double Compartment Sinks (S-1):

1. Description:
    a. Size: 33 by 19 inches (838 mm by 483 mm) nominal.
2. Design Criteria:
    a. Not required to meet NSF International Standards for Lead Free.
3. Approved Products.
    a. Elkay: LR 3319.
    b. Just: DL-1933-A-GR.
    c. Kindred: LBT 4408P-1.
    d. Elkay: LRAD 3319.
    e. Just: DL-ADA-1933-A-GR.
    f. Kindred: ALBD 4405P-1.
4. Faucets for Serving Area Sinks (S-1):
    a. Design Criteria:
        1) Meet NSF International Standards for Lead Free.
    b. Approved Products.
        1) Moen: 8227. (swivel).
        2) Speakman: SC-5724. (swivel).

F. Supply pipes with stops:
1. Design Criteria:
    a. Meet NSF International Standards for Lead Free.
2. Accessories:
    a. Provide chrome plated quarter-turn brass ball valve, 12 inches (300 mm) long braided stainless steel riser, and chrome-plated steel flange.
3. Approved Products.
    a. McGuire: BV2165CC.
    b. Zurn: Z8804 LRQ-PC.

G. Flow Control Fitting:
1. Design Criteria:
    a. Meet NSF International Standards for Lead Free.
2. Accessories:
    a. Provide vandal-proof type in place of aerator. Flow shall be 1.5 gpm.
3. Approved Product.
    a. Omni A-200 Series by Chronomite Laboratories.

H. Waste For Standard Stainless Steel Sinks:
1. Design Criteria:
    a. Not required to meet NSF International Standards for Lead Free.
2. Approved Products.
    a. Elkay: LK-99.
    b. Kindred: 1130.
    c. Kohler: K8801.
    d. McGuire: 151.
    e. Zurn Z-8740-PC.

I. Trap:
1. Description:
    a. 17 gauge (1.4 mm) tube 'P' trap, chrome plated.
2. Design Criteria:
    a. Not required to meet NSF International Standards for Lead Free.
3. Approved Products.
    a. Dearborn.
    b. Engineered Brass Company (EBC).
    c. Keeney Manufacturing.
    d. McGuire: MCT150075NCZN.

e. Zurn.

## 2.08 SERVICE SINKS

A. Description:
1. Floor Type, enameled cast iron, 28 inches (711 mm) square with vinyl coated rim guard or 24 inches (610 mm) square with Stainless Steel rim guard.

B. Design Criteria:
1. Not required to meet NSF International Standards for Lead Free.
2. Floor Sinks (Sanitary) shall conform to requirements of ASME A112.6.7.

C. Approved Products (SS-1):
1. American Standard: Florwell Enameled Cast Iron 7741.000 with vinyl rim guard 7745.811.
2. CECO: 871.
3. Kohler: Whitby K-6710.
4. Zurn: 5850.

D. Service Sink Fittings:
1. Design Criteria:
a. Not required to meet NSF International Standards for Lead Free.
2. Supply:
a. Mounting height of 42 inches (1 050 mm).
b. Provide 48 inch (1 200 mm) hose and clamp unless spout is threaded.
3. Approved Products:
a. American Standard: Exposed Yoke Wall-Mount Utility Faucet with top brace 8344.112 with threaded spout.
b. Chicago: 897 CP.
c. Delta: 28T9 with 28T911 hose and bracket.
d. Gerber: C4-44-654.
e. Kohler: K-8928.

## 2.09 HANDICAP ACCESSIBLE BI-LEVEL COOLER

A. Design Criteria:
1. Vandal proof operating bar on front and both sides.
2. 8 GPH (30.3 LPH) water at 50 deg F (10 deg C) water cooled from 80°F (26.7°C) inlet water and 90°F (32.2°C) ambient per ASHRAE testing.
3. 115-120 V, 60 Hz, single phase.
4. Flexible bubbler.
5. Build-In strainer.
6. Meets state and federal requirements for both children or adults as defined by the Americans with Disabilities Act.

B. Approved Products.
1. Elkay: Model EZSTL8LC.
2. Halsey Taylor: Model HAC8FSBL-Q-ADA.
3. Murdock Manufacturing: Model A172408B-UBL.
4. Oasis: Model PG8ACSL.

## 2.10 OUTDOOR HANDICAP ACCESSIBLE BI-LEVEL DRINKING FOUNTAIN

A. Design Criteria:
1. Floor mount/freestanding for outdoor applications.
2. Vandal resistant.
3. Non-refrigerated.
4. Vandal resistant bubbler.
5. Meets state and federal requirements for both children or adults as defined by the Americans with Disabilities Act.
6. Color by architect.

B. Approved Products.
   1. Most Dependable Fountains, Inc: Model 440 SM RAL.
   2. Elkay: Model LK4420.
   3. Murdock Manufacturing: Model GRM45.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

### 3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

### 3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

F. Install each fixture with separate vent line. Do not circuit vent.

G. Ensure provisions are made for proper support of fixtures and that rough-in piping is accurately set and protected from movement and damage.
   1. Seal wall-mounted fixtures around edges to wall with sealant specified in Section 07 9213 'Elastomeric Joint Sealants'.
   2. Attach wall-hung fixtures to carriers.
   3. Support fixture hanger or arm free of finished wall.

H. Adjust flush valves for proper flow.

I. Provide each individual fixture supply with accessible chrome-plated stop valve with hand wheel.

J. Self-Supporting Lavatories: Install using carriers. Support carrier free of finished wall.

K. Install Safety Covers on all under sink / lavatories with exposed water supply pipes and traps.

L. Install Handicap Accessible Lavatories as per ADA height mounting requirements.

M. Urinals: Install with accessible stop or control valve in each branch supply line.

N. Mounting:
   1. Urinals:
      a. Standard: 24 inches (610 mm) from floor to bottom lip.
      b. Handicap Accessible: 17 inches (432 mm) maximum from floor to bottom lip.

O. Water Closets:
   1. Floor or Wall Fixtures:
      a. Make fixture connections with approved brand of cast iron flange, soldered or caulked securely to waste pipe. Make joints between fixtures and flanges tight with approved fixture setting compound or gaskets. Caulk between fixtures with sealant specified in Section 07 9213. Point edges.

P. Flush Valve Filters:

1. Install in Sloan and Zurn only flush valves.
2. Install after water lines have been flushed out, but before turning water into flush valve.

Q. Service Sink:
1. Follow Manufacture's written instructions including but not limited to the following:
a. Install wall guard panels over galvanized flange of service sink and over FRP panels on both walls.
b. Apply sealant between flanges and wall guard and edges of wall guard.

R. Drinking Fountains and Water Cooler:
1. Mounting:
a. General:
1) Coordinate location of fountain with location and height of electrical outlet to ensure concealment of outlet by fountain.
2) Anchor bottom of fountain to wall.
3) Install 3/8 inch (9.5 mm) IPS union connection and Chicago No. 441 stop to building supply line.
4) Install 1-1/4 inch (32 mm) IPS slip cast brass 'P' trap. Install trap so it is concealed.
b. Accessible Drinking Fountains:
1) Spout outlets of wheelchair accessible drinking fountains shall be 36 inches (915 mm) maximum above floor.
2) Spout outlets of drinking fountains for standing persons shall be 38 inches (965 mm) and 43 inches (1090 mm) maximum above floor.

## 3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

## 3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

## 3.06 CLEANING

A. Clean plumbing fixtures and equipment.

B. Polish chrome finish at completion of Project.

C. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

**END OF SECTION 22 4000**

**SECTION 22 4240**
**FONT FAUCETS, SUPPLIES, AND TRIM**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install miscellaneous plumbing specialties for font as described in Contract Documents including:
      a. Font valve box.
      b. Font fittings.
      c. Traps.

### 1.02 RELATED REQUIREMENTS

A. Section 22 0501 - Common Work Results for Plumbing.

B. Section 22 1005 - Plumbing Piping.

C. Section 22 3000 - Plumbing Equipment.

### 1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide current edition.

B. ITS (DIR) - Directory of Listed Products Current Edition.

C. NEMA MG 1 - Motors and Generators 2021.

D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL (DIR) - Online Certifications Directory Current Edition.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of font supply, drain, and overflow with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.
         1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
         2) Include name, address, and phone number of each supplier.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Accept valves on site in shipping containers with labeling in place.
   2. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage and Handling Requirements:
   1. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by Architect until installed.
   2. Store items subject to moisture damage in dry, heated spaces.

**1.07 WARRANTY**

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty:
   1. Provide certificates of warranty for each piece of equipment made out in favor of the Owner.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A. American Standard Plumbing; www.americanstandard.com.

B. Cooper B-Line; www.bline.com.

C. Dearborn Brass; www.dearbornbrass.com.

D. Eljer Plumbingware, www.eljer.com.

E. Hoffman Engineering; www.hoffmanonline.com.

F. HO Trerice; www.hotco.com.

G. Jones Stephens Corp; www.plumbest.com.

H. Josam Co; Michigan City; www.josam.com.

I. Jay R. Smith Manufacturing Co; www.jrsmith.com.

J. Kohler Co Plumbing Div; www.us.kohler.com.

K. Marsh Instruments; www.marshbellofram.com.

L. Plumbing Products Co / Trim To The Trade; www.trimtothetrade.com.

M. Wade Div Tyler Pipe; www.wadedrains.com.

N. Weiss Instruments Corp; www.weissinstruments.com.

O. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 COMPONENTS**

A. Font Valve Box (match size indicated on Contract Drawings):
   1. 18 inches tall by 12 inches by 4 inches deep electrical equipment cabinet flush with removal trim and hinged locking door
   2. Acceptable Products:
      a. Model 18124 TCF, less wood panel, by Cooper B-Line.
      b. Model ATC18124F, less wood panel, by Hoffman Engineering.
      c. Equal as approved by Architect before installation. See Section 01 6200.

B. Font Fittings:
   1. Supply Outlet:
      a. Chrome plated, 1/2 inches tapping, 5 inches long.
      b. Approved Products. See Section 01 6200:
         1) 8888.056 by American Standard.
         2) K-6854 by Kohler.
   2. Temperature Gauge:
      a. Range 30 to 180 degrees F, 3-1/2 inch diameter dial, 1/2 inch MNPT connection by 5-3/8 inches immersion length.
      b. Approved Products. See Section 01 6200:
         1) 3375 by Marsh.
         2) 3-1/2 V80030 with bulb 5-3JC1 by HO Trerice.

3) 3BM25 by Weiss.

3. Traps:
   a. Approved Products. See Section 01 6200:
      1) Z-1000 by Tubular Brass Plumbing Products
      2) .08150 by Josam.
      3) W-2425-T by Wade.
      4) 7220 by J. R. Smith.
4. Drain And Overflow:
   a. 2 inch IPS Roman tube drain complete with bolts, ‘O’ ring, and top.
   b. 1-1/2 inch IPS overflow drain complete with grill, crown, and screws.
   c. Polished chrome finish.
   d. Approved Products. See Section 01 6200:
      1) 4T-6420 by Plumbing Products / Trim To The Trade.

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

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**SECTION 23 0501**
**COMMON WORK RESULTS FOR HVAC**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Common requirements and procedures for HVAC systems.
   2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
   3. Interface with Testing And Balancing Agency.
   4. Furnish and install sealants relating to installation of systems installed under this Division.
   5. Furnish and install Firestop Penetration Systems for HVAC system penetrations as described in Contract Documents.
   6. Furnish and install sound, vibration, and seismic control elements.

B. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, and equipment for mechanical systems installed under other Sections.

C. Related Requirements:
   1. Section 03 3000 - Cast-in-Place Concrete for exterior concrete pads and bases for mechanical equipment.

D. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, supports, and equipment for mechanical systems installed under other Sections.
   2. Section 05 5000 - Metal Fabrications for quality and requirements for welding.
   3. Section 07 8400 - Firestopping for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
   4. Section 07 9200 - Joint Sealants for quality of sealants used at building exterior.
   5. Section 07 9200 - Joint Sealants for quality of acoustical sealants.
   6. Section 09 9113 - Exterior Painting: Painting of mechanical items requiring field painting.
   7. Section 09 9123 - Interior Painting: Painting of plumbing items requiring field painting.
   8. Section 26 2913 - Enclosed Controllers for magnetic starters and thermal protective devices (heaters) not factory mounted integral part of mechanical equipment.
   9. Division 26: Raceway and conduit, unless specified otherwise, line voltage wiring, outlets, and disconnect switches.
   10. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.
   11. Sections Under 33 5000 Heading: Fuel Distribution Utilities.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Exterior concrete pads and bases for mechanical equipment.

B. Section 05 5000 - Metal Fabrications: Quality and requirements for welding.

C. Section 07 8400 - Firestopping: Quality of penetration firestop systems to be used on Project and submittal requirements.

D. Section 07 9200 - Joint Sealants: Elastomeric Joint Sealant: Quality at building exterior.

E. Section 09 9113 - Exterior Painting: Painting of mechanical items requiring field painting.

F. Section 09 9123 - Interior Painting: Painting of plumbing items requiring field painting.

G. Section 22 1005 Plumbing Piping [for condensate piping]

H. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

I. Division 26: 'Electrical' for raceway and conduit, unless specified otherwise, and line voltage wiring.

J. Division 33: 'Utilities' for piped utilities.

K. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

**1.03 REFERENCE STANDARDS**

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. FM (AG) - FM Approval Guide current edition.

C. ITS (DIR) - Directory of Listed Products Current Edition.

D. NEMA MG 1 - Motors and Generators 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory Current Edition.

**1.04 ADMINISTRATIVE REQUIREMENTS**

A. Coordination: Coordinate the installation of natural gas piping with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

**1.05 SUBMITTALS**

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.
         1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
         2) Include name, address, and phone number of each supplier.
      b. Informational Submittals:
         1) Design Submittals:
            (a) See individual Specification Sections in Division 23 for Submittals required.
         2) Qualification Statement:
            (a) HVAC Subcontractor:
               (1) Provide Qualification documentation if requested by Architect or Owner.
            (b) Installer:
               (1) Provide Qualification documentation if requested by Architect or Owner.

C. Shop Drawings:
   1. Schematic control diagrams for each separate fan system, heating system, control panel, etc. Each diagram shall show locations of all control and operational components and devices. Mark correct operating settings for each control device on these diagrams.
   2. Diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays. Include drawings showing electrical power requirements and connection locations.
   3. Drawing of each temperature control panel identifying components in panels and their function.

4. Other shop drawings required by Division 23 trade Sections.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Test Reports: Indicate final airflow values of every diffuser, fan unit, and exhaust fan.

F. Evaluation Service Reports: Show compliance with specified requirements.

G. Designer's Qualification Statement.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Project Record Documents: Record actual locations of all ductwork, natural gas piping, equipment, and duct/pipe accessories.

## 1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Perform work in accordance with applicable provisions of Mechanical Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
   2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
   3. Identification:
      a. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

B. Qualifications: Requirements of Section 01 4000 - Quality Requirements apply, but not limited to the following:
   1. Mechanical Subcontractor:
      a. Company specializing in performing work of this section.
         1) Minimum five (5) years experience in HVAC installations.
         2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
      b. Upon request, submit documentation.
   2. Installer:
      a. Licensed for area of Project.
      b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
      c. Upon request, submit documentation.

C. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

E. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

F. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

G. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Accept valves on site in shipping containers with labeling in place.
   2. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage and Handling Requirements:
   1. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by Architect until installed.
   2. Store items subject to moisture damage in dry, heated spaces.

**1.08 WARRANTY**

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty:
   1. Provide certificates of warranty for each piece of equipment made out in favor of the Owner.

C. Special Warranty:
   1. Guarantee mechanical systems to be free from noise and vibration in operation that may develop from failure to construct system in accordance with Contract Documents.
   2. If mechanical sub-contractor with offices located more than 150 miles from Project site is used, provide service / warranty work agreement for warranty period with local mechanical sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

**PART 2 PRODUCTS**

**2.01 COMPONENTS**

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

B. Pipe and Pipe Fittings:
   1. Weld-O-Let and Screw-O-Let fittings are acceptable.

C. Sleeves:
   1. General:
      a. Two sizes larger than bare pipe or insulation on insulated pipe.
   2. In Concrete and Masonry:
      a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 gage galvanized sheet metal.

D. Valves:
   1. Valves of same type shall be of same manufacturer.

**PART 3 EXECUTION**

**3.01 INSTALLERS**

A. Acceptable Installers:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

B. Substitution Limitations: Same as specified for products; see Section 01 6000 - Product Requirements.

**3.02 INSTALLERS (SELECT ONE OF THE FOLLOWING THREE OPTIONS)**

A. Approved Installers. See Section 01 4000 - Quality Requirements:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

**3.03 EXAMINATION**

A. Drawings:
   1. HVAC Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over HVAC Drawings.
3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification of Conditions:
1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which mechanical work is dependent for efficiency and report work that requires correction.
2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
3. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
4. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

## 3.04 PREPARATION

A. Changes Due to Equipment Selection:
1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.
2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
4. Be responsible for proper location of rough-in and connections provided under other Divisions.

## 3.05 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Interface With Other Work:
1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and see they are properly installed.
2. Electrical: Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
    a. Testing And Balancing:
        1) Put HVAC systems into full operation and continue their operation during each working day of testing and balancing.
        2) Make changes in pulleys, belts, fan speeds, and dampers or add dampers as required for correct balance as recommended by Testing And Balancing Agency and at no additional cost to Owner.

C. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

D. Locating Equipment:

1. Arrange pipes, ducts, and equipment to permit ready access to valves, cocks, unions, traps, filters, starters, motors, control components, and to clear openings of doors and access panels.
2. Adjust locations of pipes, ducts, switches, panels, and equipment to accommodate work to interferences anticipated and encountered.
3. Install HVAC work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe and duct before fabrication.
    a. Right-Of-Way:
        1) Lines that pitch shall have right-of-way over those that do not pitch. For example, steam, steam condensate, and drains shall normally have right-of-way.
        2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
    b. Offsets, Transitions, and Changes in Direction:
        1) Make offsets, transitions, and changes in direction in pipes and ducts as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
        2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

E. Piping:
1. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus.
    a. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.
    b. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.
        1) Arrange so as to facilitate removal of tube bundles.
        2) Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
            (a) Make connections of dissimilar metals with di-electric unions.
            (b) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
        3) Do not use reducing bushings, street elbows, bull head tees, close nipples, or running couplings.
        4) Install piping to insure noiseless circulation.
        5) Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
    c. Do not install piping in shear walls.
2. Properly make adequate provisions for expansion, contraction, slope, and anchorage.
    a. Cut piping accurately for fabrication to measurements established at site. Remove burr and cutting slag from pipes.
    b. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
    c. Make changes in direction with proper fittings.
    d. Expansion of Thermoplastic Pipe:
        1) Provide for expansion in every 30 feet of straight run.
        2) Provide 12 inch offset below roof line in each vent line penetrating roof.

3. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade. Seal sleeves with specified sealants.
    a. Sleeves through floors shall extend 1/4 inch above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
    b. Sleeves through floors and foundation walls shall be watertight.
4. Provide spring clamp plates (escutcheons) where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.
5. Remove dirt, grease, and other foreign matter from each length of piping before installation.
    a. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
    b. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

F. Penetration Firestops:
1. Install Penetration Firestop System appropriate for penetration at mechanical systems penetrations through walls, ceilings, roofs, and top plates of walls.

G. Sealants:
1. Seal openings through building exterior caused by penetrations of elements of HVAC systems.
2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

## 3.06 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
2. Surface finishes shall exactly match existing finishes of same materials.

## 3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Field Tests:
1. Perform tests on mechanical piping systems. Furnish devices required for testing purposes.

C. Non-Conforming Work:
1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
2. Repeat tests on new material, if requested.

## 3.08 SYSTEM START-UP

A. Off-Season Start-up:
1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
2. Notify Owner seven days minimum before scheduled start-up.
3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.

4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.

B. Preparations that are to be completed before start up and operation include, but are not limited to, following:
   1. Dry out electric motors and other equipment to develop and properly maintain constant insulation resistance.
   2. Make adjustments to insure that:
      a. Equipment alignments and clearances are adjusted to allowable tolerances.
      b. Nuts and bolts and other types of anchors and fasteners are properly and securely fastened.
      c. Packed, gasketed, and other types of joints are properly made up and are tight and free from leakage.
      d. Miscellaneous alignings, tightenings, and adjustings are completed so systems are tight and free from leakage and equipment performs as intended.
   3. Motors and accessories are completely operable.
   4. Inspect and test electrical circuitry, connections, and voltages to be properly connected and free from shorts.
   5. Adjust drives for proper alignment and tension.
   6. Make certain filters in equipment for moving air are new and of specified type.
   7. Properly lubricate and run-in bearings in accordance with Manufacturer's directions and recommendations.

## 3.09 CLEANING

A. Clean exposed piping, ductwork, and equipment.

B. No more than one week before Final Inspection, flush out bearings and clean other lubricated surfaces with flushing oil. Provide best quality and grade of lubricant specified by Equipment Manufacturer.

C. Replace filters in equipment for moving air with new filters of specified type no more than one week before Final Inspection.

D. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

## 3.10 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
   2. At beginning of HVAC section of Operations And Maintenance Manual, provide master index showing items included.
   3. Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and HVAC, Sheet Metal, Refrigeration, and Temperature Control subcontractors.
   4. Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
   5. List of HVAC equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
   6. Manufacturer's maintenance instructions for each piece of HVAC equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
   7. Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
   8. Manual for Honeywell thermostat used and published by Honeywell.
   9. Provide operating instructions to include:

a. General description of each HVAC system.
b. Step by step procedure to follow in putting each piece of HVAC equipment into operation.
c. Provide diagrams for electrical control system showing wiring of items such as smoke detectors, fuses, interlocks, electrical switches, and relays.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Instruction of Owner:
1. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of mechanical systems utilizing Operation And Maintenance Manual when so doing.
2. Instruct building maintenance personnel and Facility Manager in operation and maintenance of mechanical systems utilizing Operation And Maintenance Manual when so doing.
3. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.
4. Demonstrate proper operation of equipment to Owner's designated representative.
5. Demonstration: Demonstrate operation of system to Owner's personnel.
a. Use operation and maintenance data as reference during demonstration.
b. Conduct walking tour of project.
c. Briefly describe function, operation, and maintenance of each component.
6. Training: Train Owner's personnel on operation and maintenance of system.
a. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
b. Provide minimum of two hours of training.
c. Instructor: Manufacturer's training personnel.
d. Location: At project site.

D. Warranty Documentation:
1. Include copies of warranties required in individual Sections of Division 23.
2. Manufacturers documentation.
3. Record Documentation.
4. Copies of approved shop drawings.

## 3.11 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

B. Do not operate pieces of equipment used for moving supply air without proper air filters installed properly in system. Install temporary filters or coverings on all return grills.

**END OF SECTION**

**SECTION 23 0548**
**VIBRATION AND SEISMIC CONTROLS FOR HVAC**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Vibration-isolated equipment support bases.

### 1.02 INCLUDES BUT NOT LIMITED TO

A. Quality of and requirements for anchorage and seismic restraint systems and vibration isolation systems for HVAC piping and equipment.

### 1.03 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 03 3053: Miscellaneous Exterior Cast-In-Place Concrete.

C. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

D. Furnishing and installing of seismic restraint and vibration isolation systems is by installer of equipment requiring such systems. Manufacturers of equipment specified for seismic restraint shall provide product data needed for calculation of seismic restraint needs. This information shall include, but not be limited to, equipment dimensions, dimensioned anchor points, operating weight, and center of gravity dimension.

### 1.04 DEFINITIONS

A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

C. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

### 1.05 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.

E. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.

F. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

G. VISCMA 101 - Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems; 2015.

H. VISCMA 102 - Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems; 2012.

### 1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.

2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Seismic Controls:
    a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
    b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

## 1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Action Submittals:
1. Product Data:
    a. Restraint system and anchorage method to be used for each piece of equipment.
    b. Seismic restraints and calculations for all flexible mounted equipment.
    c. Vibration isolators and flexible couplings.
    d. Clearly outlined procedures for installing and adjusting isolators, seismic bracing anchors, and snubbers.
2. Shop Drawings:
    a. Show size, hanger length, and location of seismic restraints for piping and ductwork.
    b. Show details for each isolator and seismic brace with snubbers proposed for specified equipment.
    c. Show details for proposed structural steel frames and rails and for anchors to be used in conjunction with isolation of equipment.
    d. Show locations of piping and ductwork restraints on installation and fabrication floor plans (not bid set of documents of floor plans), noting size and type of restraint to be used.
    e. Show details of supports, hangers, anchorage, and bracing for isolated equipment as designed or proposed by professional engineer employed by Restraint Manufacturer and qualified with seismic experience in bracing for mechanical equipment. Shop drawings submitted for seismic bracing and anchors shall bear engineer's signed professional seal.
    f. Include anchor bolt calculations, signed and stamped by registered engineer, showing adequacy of bolt sizing and type.
        1) Calculations shall include anchor embedment, minimum edge distance and minimum center distance.
        2) Design lateral forces shall be distributed in proportion to mass distribution of equipment.
        3) Furnish calculations for anchors on restraint devices, cable, isolators, and on rigidly mounted equipment.

C. Certification for seismically qualified equipment; identify basis for certification.

D. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Evidence of qualifications for seismic controls designer.

G. Evidence of qualifications for manufacturer.

H. Manufacturer’s detailed field testing and inspection procedures.

I. Field quality control test reports.

## 1.08 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
   1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## 1.09 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

# PART 2 PRODUCTS

## 2.01 ASSEMBLIES

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Amber / Booth Company, Houston, TX www.amberbooth.com.
      b. Mason Industries Inc, Hauppauge, NY www.mason-ind.com.
      c. Vibration Mountings and Control Inc, Bloomington, NJ (201) 838-1780.
      d. Equal as approved by Architect before bidding. See Section 01 6200.

B. Performance:
   1. Design Criteria:
      a. Isolation And Seismic Equipment:
         1) Piping: Restrain piping in accordance with ANSI/SMACNA 001 Seismic Restraint Manual, Chapter 4, Figures 4.11 to 4.19.
         2) Equipment with Fixed Anchor or Support:
            (a) Restraint designed according to ASCE/SEI 7-10, Chapter 13, 'Seismic Design Requirements For Nonstructural Components'.
            (b) Horizontal force factor for elements of structures:
            (c) In addition, vertical force restraint requirement shall be computed at 1/2 value of horizontal forces.
            (d) Restrain equipment not anchored directly to floors by cable system designed and furnished by Restraint Manufacturer.
         3) Ductwork: Restrain ductwork in accordance with ANSI/SMACNA 001 Seismic Restraint Manual, Chapter 4, Figures 4.2 to 4.10 as appropriate.
      b. Vibration Isolation Requirements:
         1) Isolate equipment from structure by means of resilient vibration and noise isolators.
         2) Unless otherwise noted, isolate HVAC equipment one horsepower and over from structure by means of resilient vibration and noise isolators in accordance with ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms'.
         3) Design and install isolation equipment, hangers, connections, and other isolating devices to prevent transmission of vibration to structure from equipment and associated piping and ductwork.

4) For floor-mounted equipment, use recommendations with ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms'.
5) For roofs and floors constructed with open web joints, thin long span slabs, wooden construction and unusual light weight construction, evaluate equipment weighing more than 300 pounds to determine additional deflection of structure caused by equipment weight. Isolator deflection shall be 15 times additional deflection or deflection shown in ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms', whichever is greater.
6) Under-Equipment Spring Isolators:
   (a) Equal to Mason SSLFH earthquake motion restrained spring mounts with freestanding stable steel springs, leveling bolts, corrosion resistant finish, motion limiting design, uplift restraining bolts, and 1/4 inch (6 mm) ribbed neoprene noise stop pad.
   (b) Isolators shall accept force in any direction up to 1.0 g without failure, and shall limit movement to 3/4 inch (19 mm) in any direction.
   (c) Springs shall have 50 percent overload capacity.
   (d) Size as required to achieve specified static deflection.
   (e) Outer diameter of spring proper shall not be less than 0.8 of spring height when in loaded position.
7) Overhead Support Spring And Rubber Hangers:
   (a) Combination spring and neoprene hangers.
   (b) Hanger bracket shall have 500 percent overload capability and shall allow up to 15 degree hanger rod misalignment without short-circuiting.
   (c) Springs shall have 50 percent overload capacity.
   (d) Provide seismic bracing as required.
8) Isolate piping and ductwork in mechanical equipment room and piping and ductwork three supports away or 50 feet (15 meters) from other mechanical equipment, whichever is greater, from structure by means of vibration and noise isolators.
   (a) Isolate suspended piping with combination spring and fiberglass hangers in supporting rods.
   (b) Support floor-mounted piping directly on spring mounts.
9) Isolate vertical pipe risers from structure using vibration and noise isolating expansion hangers having minimum rated deflection of four times anticipated pipe movement. Enclose in housing for fail-safe equipment.
10) Incorporate flexible connectors in piping adjacent to reciprocating equipment.
11) Incorporate flexible connections in ductwork adjacent to air-moving units.
12) Elastomeric Isolator: Neoprene or high quality synthetic rubber with anti-ozone and anti-oxidant additives.
13) Nuts, Bolts, And Washers: Electroplated zinc.
14) Isolators Exposed To Weather: Cadmium plated and neoprene coated springs.

c. Seismic Requirements:
1) Mechanical equipment, piping, and ductwork shall be braced, snubbed, or supported to withstand seismic disturbances and remain operational.
2) Seismic restraint equipment and resilient isolation devices shall be designed and furnished by a single Manufacturer.

C. Finishes:
1. Clean and paint steel components. Thoroughly clean structural steel bases of welding slag and prime with zinc-chromate or metal etching primer. Etch and paint hot dipped galvanized steel components.

**PART 3 EXECUTION**

## 3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

## 3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Field-Welding (where approved by Architect): Comply with Section 05 5000.

E. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Isolation Equipment:
   1. Mount vibration isolated equipment on rigid steel frames or concrete bases unless Equipment Manufacturer certifies direct attachment capability.
   2. Install snubbers with factory set clearances.
   3. Piping:
      a. Protect isolated and non-isolated piping 2-1/2 inches (64 mm) inside diameter and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motions.
      b. Locations shall be as scheduled and include, but not be limited to:
         1) At drops to equipment and at flexible connections.
         2) At 45 degree or greater changes in direction of pipe.
         3) At horizontal runs of pipe 30 feet (9.15 m) maximum on center spacing.
         4) Gas piping shall have additional restraints as scheduled.
   4. Ductwork:
      a. Protect isolated and non-isolated rectangular ductwork 4 feet square (0.372 sq m) in cross-sectional area and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motion.
      b. Locations shall be determined by Seismic Restraint Manufacturer and include, but not be limited to:
         1) Horizontal runs of ductwork 30 feet (9.15 m) maximum on center spacing.
         2) 45 degree or greater changes in direction of ductwork.
         3) Each end of duct runs and drops of equipment.
         4) Each flexible connection.

G. Vibration Isolation: Install piping and ductwork to prevent transmission of noise and vibration into structure.

## 3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Provide manufacturer representative or authorized technician services to assist with inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.

D. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify required clearance beneath vibration-isolated equipment support bases.
   3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

E. Seismic Controls:
   1. Verify snubbing element air gaps.

F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

## 3.04 ATTACHMENTS

A. Statement of special inspections.

**END OF SECTION**

## SECTION 23 0553
## IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Stencils.

E. Pipe markers.

F. Ceiling tacks.

### 1.02 SUMMARY

A. Products Furnished But not Installed Under This Section:
   1. Identification of HVAC piping and equipment as described in Contract Documents including:
      a. Paint identification for gas piping used in HVAC equipment.
      b. Stencils and band colors for gas piping used in HVAC equipment.

B. Related Requirements:
   1. Section 09 9124: ‘Interior Painted Metal’ for providing field painting of identification of piping used with HVAC equipment.
   2. Section 22 0529: 'Hangers And Supports For Plumbing’ for field installation of pipe stencils and band colors for identification for piping used with HVAC equipment.

### 1.03 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

### 1.04 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

### PART 2 PRODUCTS

### 2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Dampers: Ceiling tacks, where located above lay-in ceiling.

E. Ductwork: Nameplates.

F. Heat Transfer Equipment: Nameplates.

G. Instrumentation: Tags.

H. Major Control Components: Nameplates.

I. Piping: Tags.

J. Relays: Tags.

K. Small-sized Equipment: Tags.

L. Tanks: Nameplates.

M. Thermostats: Nameplates.

N. Valves: Tags and ceiling tacks where located above lay-in ceiling.

O. Water Treatment Devices: Nameplates.

## 2.02 ABBREVIATIONS FOR PIPE STENCILS AND EQUIPMENT IDENTIFICATION AND BAND COLORS FOR PIPE IDENTIFICATION

A. Apply stenciled symbols and continuous painting as follows:

1. Mechanical Mezzanine and Exposed on Roof:

| Pipe Type | Pipe Color |
|---|---|
| Gas | Yellow |

## 2.03 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

## 2.04 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
2. Brady Corporation: www.bradycorp.com/#sle.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

## 2.05 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com/#sle.
2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.

B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

C. Style: Individual Label.

D. Color: Yellow/Black.

**2.06 STENCILS**

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
   4. Ductwork and Equipment: 2-1/2 inch high letters.

**2.07 PIPE MARKERS**

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. MIFAB, Inc: www.mifab.com/#sle.
   6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

**2.08 CEILING TACKS**

A. Manufacturers:
   1. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Steel with 3/4 inch diameter color coded head.

**PART 3 EXECUTION**

**3.01 PREPARATION**

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

**3.02 INSTALLATION**

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

H. Labels:
   1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
      a. Thermostats and control panels in mechanical spaces (attach label to wall directly above or below thermostats).
      b. Furnaces.
      c. Condensing units.
      d. Unit Heaters.
      e. Accessible exhaust fans.
   2. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
      a. Thermostats and control panels in mechanical spaces (attach label to wall directly above or below thermostats).
      b. Unit Heaters.
      c. Accessible exhaust fans.
   3. Engrave following data from Equipment Schedules on Drawings onto labels:
      a. Equipment mark.
      b. Area served.
      c. Thermostat zone number, when different from equipment mark.
      d. Panel and breaker from which unit is powered.

I. Pipe Markers:
   1. Wrap pipe marker around pipe with 1/2 inch (12.7 mm) minimum overlap. Use adhesive strip at overlap to adhere ends of marker together.
   2. Locate markers as follows:
      a. Adjacent to each item of equipment.
      b. At points of entry and exit where piping goes through wall.
      c. On each riser and junction.
      d. Every 25 feet (7.620 m) maximum on long, continuous runs.

J. Painting:
   1. New Surfaces:
      a. Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
   2. Leave equipment in like-new appearance.
   3. Only painted legends, directional arrows, and color bands are acceptable.
   4. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
      a. Adjacent to each item of equipment.
      b. At point of entry and exit where piping goes through wall.
      c. On each riser and junction.
      d. Every 25 feet (7.620 m) on long continuous lines.
      e. Stenciled symbols shall be one inch (25 mm) high and black.

**END OF SECTION**

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**SECTION 23 0713**
**DUCT INSULATION**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install thermal wrap duct insulation as described in Contract Documents.

### 1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Samples: Submit two samples of any representative size illustrating each insulation type.

D. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

### 1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience and approved by manufacturer.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

### 1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

## PART 2 PRODUCTS

### 2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

B. Manufacturers contact list

### 2.02 THERMAL WRAP DUCT INSULATION

A. 1-1/2 inch (38 mm) or 3 inch (76 mm) thick fiberglass with factory-laminated, reinforced aluminum foil scrim kraft facing and density of 0.75 lb / per cu ft (12 kg / per cu m).

B. Thermal Conductivity: 0.27 BTU in/HR SF deg F at 75 deg F (24 deg C) maximum.

C. Acceptable Products:
   1. Type 75 standard duct insulation by Certainteed St Gobain.

2. Microlite FSK by Johns-Manville.
3. Duct Wrap FSK by Knauf Fiber Glass.
4. Alley Wrap FSK by Manson Insulation Inc.
5. FRK by Owens-Corning.
6. Equal as approved by Architect before bidding. See Section 01 6200.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive:
1. For indoor applications:
a. Provide adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

### 3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:
1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

F. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

**END OF SECTION**

**SECTION 23 0719**
**HVAC PIPING INSULATION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jacketing and accessories.

### 1.02 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install insulation on above ground refrigerant piping and fittings as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. Section 23 0501 - Common Work Results for HVAC.

B. Section 23 2300 - Refrigerant Piping: Placement of inserts.

### 1.04 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2019).

C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement 2007 (Reapproved 2019).

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.

F. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2022.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Samples: Submit two samples of any representative size illustrating each insulation type.

D. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

### 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Storage And Handling Requirements:
   1. Keep materials and work dry and free from damage.
   2. Replace wet or damaged materials at no additional cost to Owner.

## 1.08 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

# PART 2 PRODUCTS

## 2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

## 2.02 GENERAL MANUFACTURERS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Armacell; www.armaflex.com.
      b. Childers Products Co; www.fosterproducts.com.
      c. Foster Products Corp; www.fosterproducts.com.
      d. Johns-Manville; www.jm.com.
      e. Knauf; www.knauffiberglass.com.
      f. Manson; www.isolationmanson.com.
      g. Nitron Industries; www.nitronindustries.com.
      h. Owens-Corning; www.owenscorning.com; (416) 733-1600.
      i. Ramco; www.ramco.com.
      j. Nomac; www.nomaco.com.
      k. Speedline Corp; www.speedlinepvc.com.

B. Materials:
   1. Refrigeration Piping System:
      a. Thickness:
         1) Pipe Size, Outside Diameter: Insulation Thickness
            (a) One inch and smaller: 1/2 Inch
            (b) 1-1/8 to 2 inch: 3/4 Inch
         2) One inch sheet for fittings as recommended by Manufacturer.
         3) Approved Products. See Section 01 6200:
            (a) AP Armaflex 25/50 by Armacell.
            (b) Nitrolite by Nitron Industries. White only for exterior.
            (c) Nomaco K-Flex.
      b. Thickness:
         1) Pipe Size, Outside Diameter: Insulation Thickness
            (a) 25 mm and smaller: 13 mm
            (b) 29 to 50 mm: 19 mm
         2) 25 mm sheet for fittings as recommended by Manufacturer.
         3) Approved Products. See Section 01 6200:
            (a) AP Armaflex 25/50 by Armacell.
            (b) Nitrolite by Nitron Industries. White only for exterior.
            (c) Nomaco K-Flex.
      c. Joint Sealer:
         1) For indoor applications:

2) Provide adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3) Approved Products. See Section 01 6200:
   (a) Armacell 520 by Armacell.
   (b) Namaco K-Flex R-373.
4) Insulation Tape:
   (a) Approved Products. See Section 01 6200:
      (1) Armaflex AP Insul Tape by Armacell.
      (2) FT182 Tape by Nitron Industries.
      (3) Elastomeric Foamtape by Nomac K-Flex.
5) Exterior Finish:
   (a) For application to non-white, exterior insulation.
   (b) Approved Products. See Section 01 6200:
      (1) WB Armaflex Finish by Armacell.
      (2) R-374 Protective Coating by Nomaco K-Flex.

**2.03 GLASS FIBER, RIGID**

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation
      ASJ: www.ocbuildingspec.com/#sle.
   5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 650 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

E. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

F. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

G. Vapor Barrier Lap Adhesive: Compatible with insulation.

H. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

I. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 pcf density.
   3. Weave: 5 by 5.

J. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

K. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

L. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

M. Insulating Cement: ASTM C449.

## 2.04 CELLULAR GLASS

A. Manufacturers:
   1. Owens Corning Corporation; FOAMGLAS: www.ocbuildingspec.com/#sle.

B. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.
   1. K Value: 0.35 at 100 degrees F.
   2. Service Temperature Range: From 250 degrees F to 800 degrees F.
   3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
   4. Water Absorption: 0.5 percent by volume, maximum.
   5. Density: A minimum of 6.12 pcf.

C. Block Insulation: ASTM C552, Type I, Grade 6.
   1. K Value: 0.35 at 100 degrees F.
   2. Service Temperature: 800 degrees F, maximum.
   3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
   4. Water Absorption: 0.5 percent by volume, maximum.

## 2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com/#sle.
   2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
   3. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

## 2.06 JACKETING AND ACCESSORIES

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

## 3.02 PREPARATION

A. Before application of insulating materials, brush clean surfaces to be insulated and make free from rust, scale, grease, dirt, moisture, and any other deleterious materials.

B. Use drop cloths over equipment and structure to prevent adhesives and other materials spotting the work.

## 3.03 INSTALLATION

A. Refrigeration System Piping System:
   1. General:
      a. Install insulation in snug contact with pipe.
         1) Insulate flexible pipe connectors.
         2) Insulate thermal expansion valves with insulating tape.
         3) Insulate fittings with sheet insulation and as recommended by Manufacturer.
      b. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.
      c. Do not install insulation on lines through clamp assembly of pipe support. Butt insulation up against sides of clamp assembly.
      d. Stagger joints on layered insulation. Seal joints in insulation.
      e. Install insulation exposed outside building so 'slit' joint seams are placed on bottom of pipe.
      f. Paint exterior exposed, non-white insulation with two coats of specified exterior finish.
   2. System Requirements:
      a. Condensing Units: Install insulation on above ground refrigerant suction piping and fittings, including thermal bulb, from thermal expansion valve.

B. Install in accordance with manufacturer's instructions.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

## 3.04 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Method of installing insulation shall be subject to approval of Architect. Sloppy or unworkmanlike installations are not acceptable.

## 3.05 CLEANING

A. Leave premises thoroughly clean and free from insulating debris.

## 3.06 PROTECTION

A. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

**END OF SECTION**

**SECTION 23 0923.01**
**DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Included But Not Limited To:
   1. Furnish and install automatic temperature control system as described in Contract Documents.
   2. Honeywell LCBS Connect based systems
   3. Furnish and install conductors and make connections to control devices, motors, and associated equipment.
   4. Assist in air test and balance procedure.

### 1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

B. Section 23 0501 - Common Work Results for HVAC.

C. Section 23 3300 - Air Duct Accessories: Furnishing and installing of temperature control dampers.

D. Division 26:
   1. Furnishing and installing of raceway, conduit, and junction boxes, including pull wires, for temperature control system except as noted above.
   2. Power wiring to magnetic starters, disconnect switches, and motors.
   3. Motor starters and disconnect switches, unless integral with packaged equipment.

### 1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL (DIR) - Online Certifications Directory Current Edition.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Installer to provide product literature or cut sheets for all products specified in Project.
      b. Installer to provide questions of control equipment locations to Mechanical Engineer prior to installation.

C. Informational Submittals:
   1. Certificates:
      a. Installer must provide ‘Certificate of Sponsorship’ signed from Approved Distributor with bid confirming Installer sponsorship.

D. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Provide Operations and Maintenance Manual as specified in Section 23 0501.
      b. Record Documentation:
         1) Installer's 'Certificate of Sponsorship'.

E. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

F. Installer's Qualification Statement. Complete and submit signed "Certificate of Sponsorship" LCBS.

G. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Include submittals data in final "Record Documents" form.

H. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owners name and registered with manufacturer. Include copies in Operations and Maintenance Manual.

### 1.06 QUALITY ASSURANCE

A. Qualifications: Requirements of Section 01 4301 applies, but is not limited to the following:
   1. Installer:
      a. Before bidding, obtain sponsorship from a local, Approved Distributor specified under PART 2 PRODUCTS of this specification. Initial requirements for sponsorship are:
         1) Receive LCBS Connect product training from Approved Distributor.
         2) Installer to provide Distributor sponsorship by submitting ‘Certificate of Sponsorship’ as Informational Submittal with bid. Certificate available as Attachment in this Specification.

B. Perform work in accordance with NFPA 70.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

### 1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Manufacturer Contract List:
   1. Air Products & Controls Ltd; www.ap-c.com.
   2. Fire-Lite Alarms; www.firelite.com.
   3. Honeywell Inc; www.honeywell.com.
      a. Primary Contact: Chris Brinkerhoff, (801) 550-3344, chris.brinkerhoff@honeywell.com.
   4. ICCA Firex; www.icca.invensys.com.
   5. Insul_Guard:
      a. Primary Contact: Dan Craner, (801) 518-3733; insul_guard@comcast.net.
   6. System Sensor; www.systemsensor.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

B. Distributors: Obtain LCBS Connect control devices, RP panels, sensors, actuators and other control equipment from following Sponsoring Approved Distributors. See Section 01 4301:
      a. Utah:
         1) Control Equipment Co: (800) 452-1457.

2) Building Controls and Solutions LLC: (801) 214-3316; Dan.Craner@building-controls.com; Dan Craner.

C. Performance:
1. Design Criteria:
a. Honeywell LCBS Connect control system with cloud based gateway:
1) General Requirements:
(a) Controls multistage equipment, dehumidification and ventilation with 2 wire connection to controller interface location in occupied space.
(b) Adjustable backlight to controller interface module from 15 percent-100 percent after 30 seconds of setting adjustments.
(c) System controllers can be programmed from the interface module or from the cloud service.
(d) LCBS Connect controller utilizes echelon communication network with the controller located near the mechanical equipment and the system interface located in the occupied space.
(e) System shall control outdoor ventilation air based upon system occupancy of electric / electronic actuation of dampers.
(f) CO2 sensors will open ventilation dampers only when CO2 exceeds 800 ppm with ppm monitored by cloud service.
(g) LCBS Connect devices access via internet Chrome browser via gateway.
(h) Wired room temperature sensors may be added as specified.
2) System Requirements:
(a) Up to 3 Heat/2 Cool Heat Pumps; Up to 3 Heat/2 Cool Conventional Systems.
(b) Tri-Lingual display (Selectable for English, Spanish, or French).
(c) 18 to 30 Vac.
(d) 50 Hz; 60 Hz.
(e) System switch to include Auto changeover for Heat-Cool.
(f) 7-Day Programming.
(g) 365-Day Event Scheduling.
(h) Display Security Lockout options.
(i) Minimum/ Maximum Temperature Range Stops.
(j) Configurable over-ride option.
(k) Remote Access via internet.
(l) Dehumidification setting range 40 to 80 percent RH.
b. Honeywell TrueZone panel enabled device(s):
1) General Requirements: Zone Panel:
(a) Work in conjunction with LCBS Connect.
(b) Control multiple zones on single fan coil unit (gas fired furnace with air conditioning or air handling unit with heat pump).
(c) Keypad programming and checkout.
(d) Work with conventional, heat pump or dual fuel applications.
(e) Push wire terminals.
(f) Add-a-zone panel expandable.
2) Dampers:
(a) Bypass damper installs in any orientation at any angle.
(b) Bypass damper provides constant pressure relief regardless of blower speed.
(c) Bypass damper provides visual damper percentage open.
(d) Zone damper powered by 24VAC circuit from zone panel.
(e) Zone damper adjustable range stops for consistent bleed setting.
(f) Zone damper LED indicator lights (red closed, green open/ 3 wire applications).

(g) Zone damper terminals have push terminals.

D. Components:
1. Controller, Wall Module:
a. Controller and Display Kit:
1) Approved Product.
(a) Part Number Honeywell YCRL6438SR1000 consisting of following:
(1) Unitary Controller: Honeywell CRL6438SR1000
(2) Wall Module: Honeywell TS120
(b) Wall Cover Plate: Honeywell 50002883-001.
(c) Discharge Air / Return Air Sensors: Honeywell C7041B2005 20k ohms.
(d) Outdoor Air Sensor: Honeywell C7041F2006.
(e) Indoor Air Sensor:
(1) Sylk bus network; Honeywell TR40.
(f) Averaging sensor:
(1) Sylk bus network; Honeywell TR40.
b. Internet Gateway Module(s): One (1) module per thirty (30) controllers.
1) Approved Product.
(a) LCBS Connect Gateway Module: Honeywell LGW1000.
2. Zone Panel and Components:
a. Zone Panel: Honeywell TrueZone HZ322.
b. Zone Panel: Honeywell TrueZone HZ432.
c. Zone Expansion Controller X4, where required: Honeywell TAZ-4.
d. Zone Panel Transformer: AT175F1023.
e. Zone Discharge Air Temperature Sensor: Honeywell C7735A1000.
f. Zone Damper(s): Honeywell ARD (damper size) TZ round damper.
g. Zone Damper(s): Honeywell ZD (damper size) TZ rectangular damper.
h. Zone Bypass Damper: Honeywell CPRD (damper size).
3. Sealant Compound:
a. Description:
1) Non hardening waterproof, vapor proof, self-adhesive for hot or cold application for sealing conduit openings against drafts, dust, moisture and noise.
b. Approved Product.
1) Duct Seal Compound No. DS-130 by Gardner Bender; www.gardnerbender.com.
2) Thumb-Tite Sealing Compound No. 4216-92 by Nu-Calgon; www.nucalgon.com.
4. Guard for Cultural Center Sensors:
a. Match color of sensor.
b. Approved Product.
1) MSI-244 controller guard with integral wood base by Zimmerman Technologies.
2) WMG 1 controller guard by Insul_Guard.
5. Duct Smoke Detectors:
a. Duct mounted smoke detector in systems with airflow greater than 2000 CFM.
b. Intelligent low flow photoelectric duct smoke detector with flash scan.
c. Approved Product.
1) System Sensor Model D4120.
6. Transformer:
a. 120 / 24 V, 50VA Honeywell AT150F.
b. 120 / 24 V, 75VA Honeywell AT175F.
7. Damper Actuators:
a. Electric type equipped for Class I wiring.
b. Shall not consume power during Unoccupied cycle or use chemicals or expandable media.
c. Have built in spring return.

d. Approved Product.
    1) Honeywell MS8105A1030/U.
    2) Honeywell MS8105A1130 with end switch.

8. Conductors:
    a. Color-coded and No. 16 and No. 12 AWG Type TWN, TFN, or THHN, stranded.
    b. Controller Cable: 12, 8, or 4 conductor, 18AWG solid copper wire, insulated with high-density polyethylene. Conductors parallel enclosed in brown PVC jacket (22 AWG cable not allowed).
    c. Echelon Network Ebus Communicating Cable:
        1) Class Two Quality Standard. See Section 01 6200:
            (a) CAT 4, 22 gauge (0.025 in) (0.645 mm), twisted pair, non-plenum and non-shielded cable.
9. Local Relay (RP) Panels For Chapel And Cultural Center Systems:
    a. 16-ga (1.59 mm) screw cover, painted sheet metal. Box with cover and knockouts, pre-wired terminal strips, relay, and transformer.
    b. Provide Labels with Distributor contact information on each panel.
    c. Approved Products.
        1) Standard: LDS Model RP-6.
10. CO2 Return Air Sensor:
    a. Duct mount with display.
    b. Approved Product.
        1) Honeywell: C7232B1006.
11. Control for Electric Wall Heater:
    a. Electric Heater Control: CEO
        1) Combination Equipment and Thermal Overload Switch Panel:
        2) CEO panel must be provided by approved panel builder. See Section 01 6200 for definitions of Categories:
            (a) Switching Relay: Part Number Functional Devices: Relay RIB2401B 20 amp rating.
            (b) Disconnect Heater Overload: FMS-TAX5, 2-Pole 1 HP starter switch.

E. Operation Sequences:
1. Programmable controller shall control Unoccupied and Occupied status of fan system based on adjustable seven-day program. Fan shall run continuously in Occupied Mode and cycle in Unoccupied Mode.
2. Adjustable heating and cooling set points shall control space temperature by activating either heating or cooling equipment. Programmable controller provides automatic change over between heating and cooling.
3. Controller provides optional override by allowing timed override of program by pushing override on controller touch screen. This shall activate controller to Occupied Mode and system shall control to Occupied set point.
4. Minimum outdoor ventilation air damper, spring return type, shall open in controller Occupied Mode and remain closed in Unoccupied Mode.
5. Systems with CO2 sensor to control minimum, spring return type, outdoor ventilation air damper:
    a. Damper shall open in controller Occupied Mode only when CO2 sensor setpoint of 800 ppm is reached. Damper shall close if CO2 level drops below about 700 ppm.
    b. Damper shall remain closed in controller Unoccupied Mode.
6. Systems with Energy Recovery Ventilator (ERV):
    a. ERV shall activate in controller Occupied Mode and remain inactive in Unoccupied Mode.
    b. Systems with CO2 sensor to control outdoor ventilation air damper, ERV in controller shall activate ONLY when TWO conditions are present:
        1) Controller is in Occupied Mode.

2) $CO_2$ sensor setpoint of 800 ppm is reached.

## PART 3 EXECUTION

### 3.01 INSTALLERS

A. Acceptable Installers. See Section 01 4301:

### 3.02 INSTALLATION

A. Interface With Other Work:
   1. Calibrate room controllers as required during air test and balance. Insulate sensor J-box with fiberglass insulation; expandable/ foam insulation is NOT acceptable.
   2. Install sealant compound, non hardening waterproof, vapor proof, self-adhesive for hot or cold application for sealing conduit openings against drafts, dust, moisture and noise.
   3. Instruct air test and balance personnel in proper use and setting of control system components.
   4. Install low voltage electrical wiring in accordance with Division 26 of these Specifications.

B. Echelon Communication: Ebus
   1. Ebus cable needs to be installed at least 12 inches (300 mm) from lighting, motors, or low voltage switching cables

C. Zone Panel:
   1. Zone panel shall be mounted by mechanical equipment with associated LCBS module in close proximity but mounted 24 inches (610 mm) apart.
   2. Zone panel shall be mounted at eye level and accessible for visual inspection.
   3. Install discharge air sensor 6 feet (1.80 m) downstream from a/c coil.
   4. Install OA sensor in fresh air duct.
   5. TOD relay for fresh air damper which is not part of zone panel shall be mounted in close proximity to panel and clearly labeled such.
   6. Zone panel shall be programmed for appropriate amount of zones and control.
   7. Zone dampers shall use three (3) wires for LED damper display.
   8. Power for zone transformer shall come from mechanical equipment for service switch disconnect.
   9. Zone and bypass dampers shall have actuation component positioned such as for visual damper position inspection.
   10. Set minimum zone damper position to 30 percent or setting number 3.

D. Control for Electric Wall Heater.
   1. Install according to local code the electric heater RIB with overload disconnect into electric heater unit.
   2. Commission controller to be seen by gateway and webpage.

E. Safety Controls: Interlock duct smoke detectors to keep heating, cooling, and system fan from operating when detector is energized.

F. Safety Controls:
   1. Interlock main return air duct smoke detectors to keep heating, cooling, and system fan from operating when detector is energized. Interlock smoke detector for combination fire / smoke dampers so fire / smoke damper closes on detection of smoke.
   2. Interlock gas valves with cooling compressors and supply air fan.
   3. Gas valves shall obtain their electrical control power from same circuit as supply fan motor.
   4. Check high limit thermostats furnished with heating equipment for correct operation. Gas valves shall close when duct temperature exceeds high limit setting. Perform this work immediately after wiring burner controls.
   5. Wire bonnet thermostatic switches to dissipate all heat in combustion chambers.
   6. Fresh air dampers shall close on fan shut-down, power failure, open fan motor disconnect switch, and when thermostat is in Unoccupied Mode.

7. Gas burner safety controls furnished with furnace units shall be incorporated in control circuits for all modes of operation.
8. Control twinned furnace systems, where two furnaces serve common supply and return plenums, as one unit with twinning kit. Motors shall start and stop together and gas valves operate together.

G. Mount damper actuators and actuator linkages external of airflow. Make certain dampers operate freely without binding or with actuator housing moving.

H. Paste copy of record control wiring diagram on back of relay panel door cover for each multiple furnace system.

**3.03 FIELD QUALITY CONTROL**

A. Field Tests:
1. Calibrate, adjust, and set controls for proper operation, operate systems, and be prepared to prove operation of any part of control system. This work is to be completed before pre-substantial completion inspection.
2. Test each individual heating, cooling, and damper control for proper operation using control system.

**3.04 SYSTEM STARTUP**

A. For systems with LCBS Controller.
1. Contractor is responsible for a fully functioning control system accessible via internet web browser. Contractor is responsible to coordinate Network start up with assistance from local IT technician. Local IT technician shall provide available ports on network switch for LCBS gateway.
2. Contractor is responsible configuring all controllers with proper zone names, zone scheduling, proper Church conference / holiday scheduling, all to be coordinated with local FM manager. Set proper clock setting including day/month/year.
3. Set Heating / Cooling to proper stages
4. Set heat cycle rates to 9 cph and cooling to 4 cph.
5. Set DO1 relay to “Occupancy”.
6. Set System switch operation to “Automatic” changeover.
7. Set fan switch operation to “ON”.
8. Set minimum UnOcc start time for all days. No days shall be scheduled Unconfigured.
9. Set Occupied start times to match meeting start times; provided by local FM manager.
10. Place all zone over-ride durations to one (1) hour except for Bishop and Stake area which shall be set to two (2) hours.
11. Set Occupied default heating setpoints to 70 degrees, cooling setpoints to 74 degrees.
12. Set Unoccupied default heating setpoint to 60 degrees, cooling setpoints to 90 degrees.
13. Set each zone to applicable Holiday scheduling for General & Stake Conferences.
14. EH-1: Set EWH SET heating 50F (10C) minimum
    a. Set Unoccupied Setpoint
        1) Electric wall heater should always run in Unoccupied setting.

B. For systems with TrueZONE Zone Panel:
1. Contractor responsible for fully functioning zoning system connected to LCBS controller system.
2. Contractor responsible to configuring of zone panel.
3. Contractor responsible to coordinate Network start up with assistance from air balancer.

**3.05 ADJUSTING**

A. LCBS controller configuration settings; the following are configuration guidelines for consistent installations:
1. Temperature Units: Fahrenheit/ Celsius
2. Equipment Type: Conventional/heat pump
    a. Stages of Heat: 1,2

b. Stages of Cool: 1,2
c. Fan operation in heat mode: Enable Fan w/ Heat

3. Equipment Options:
   a. Leave at Default
   b. Heating Cycles per Hour: 6-9 cph
   c. Cooling Cycles per Hour: 3-4 cph
4. Recovery:
   a. Leave at Default.
5. Economizer / DLC:
   a. Configure as required by control equipment.
6. Sensor Selection:
   a. Set according to averaging sensors.
   b. Set to multi sensor “Smart” when averaging.
   c. Set Occupancy Sensor to “Disable”.
7. Terminal Assignment:
   a. Set according to equipment.
   b. Set Terminal DO1 to Occupancy to control fresh air damper based upon scheduled occupancy or over-ride.
8. Dehumidification:
   a. Leave at default.
   b. See Accessory Loops.
9. Miscellaneous:
   a. Leave at default.
10. Sensor setting:
    a. Leave at default.
    b. Set as Required
11. Accessory Loops - Set as required:
    a. Hot water valve
    b. Dehumidification
    c. Other.
12. Configure Zone Name (display on Home Screen).
13. Set Password to ABCD.
14. Set Occupied Setpoint.
15. Set Unoccupied Setpoint
16. Set Schedule.
17. MENU/ Holiday-Event Scheduler / Custom Events/ Create new event:
    a. Mountain Time Zone:
       1) First Sunday in April: Unoccupied all zones for all day / every year.
       2) First Sunday in April: Unoccupied all zones for all day / every year.
       3) First Sunday in October: Unoccupied all zones for all day / every year.
       4) First Sunday in October: Unoccupied all zones for all day / every year.

B. Zone Panel Configuration:
   1. Configuration:
      a. Conventional or Heat Pump
      b. Cooling Stages: (match equipment)
      c. Heat Stages: (match equipment)
      d. RF Enabled: (NO)
      e. Zones Installed: (match number of zones)
      f. Heat Staging Control: (percent Zones)
   2. Advanced Configuration:
      a. Heat Fan Control (HVAC)
      b. Purge Time: (2 minutes)

c. Fan in Purge: (HVAC)
d. Purge Dampers: (Unchanged)
e. Changeover Delay: (15 minutes)
f. DA temperature Sensor: (Yes)
g. DA temperature High Limit: (140 degree)
h. DA Low Limit: (35 degree)
i. DAT MSTG Inhibit: (Yes)
j. MSTG OT Lockout: (No)

3. Save Changes.

## 3.06 CLOSEOUT ACTIVITIES

A. Instruction of Owner:
1. Include as part of training required in Section 23 0501, following training:
a. Training shall be by personnel of installing company and utilize operator's manuals and as-built documentation.
b. Provide training in (2) two sessions including LCBS Connect sight & smart Apps for up to six (6) hours total:
1) First session will occur between system completion and Substantial Completion.
2) Second session will occur within forty-five (45) days of Substantial Completion when agreed upon by Owner.
c. Training shall include sequence of operation review, selection of displays, modification of schedules and setpoints, troubleshooting of sensors, etc, as follows:
1) Control System Overview:
(a) Show access to system through both individual controllers and Internet browser and how network works. Scheduling building at minimum for Stake and General Conference, special events.
2) Controller Programming from Keypad: Instructions on developing setpoints and schedules and adjusting local zone temperatures.
3) Web Internet training with local Facilities Manager during two (2) sessions.
(a) Review all features accessible from the 'Settings' tab including Alarm points, user access, scheduling and humidity setpoints (where applied).

## 3.07 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

## 3.08 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

## 3.09 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of energy management and control systems for one year from Date of Substantial Completion.

C. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

D. Provide complete service of systems, including call backs. Make minimum of 5 complete normal inspections of approximately 1 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

## 3.10 ATTACHMENTS [CERTIFICATE OF SPONSORSHIP, LCBS]

# CERTIFICATE OF SPONSORSHIP

## Electric and Electronic Control System for HVAC Installer

**PROJECT INFORMATION** (To be filled out by Installer - available from project specification):

Project Name: _____

Project Number: _____

Project Address: _____

**INSTALLER INFORMATION** (To be filled out by Installer):

Installer Name: _____

Installer Firm: _____

Installer Address: _____

I acknowledge and confirm the above listed Installer has received training and exhibit LCBS/Commercial System skills and is qualified to install the automation control system as specified for Project identified above. Our company will stand behind the Installer meeting the legal specified performance requirements.

Sponsoring Approved Honeywell Distributor Name: _____

Signature: _____ Printed Signature: _____

Date: _____

**END OF SECTION**

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**SECTION 23 1123**
**FACILITY NATURAL-GAS PIPING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

### 1.02 SUMMARY

A. Includes But Not Limited To:
   1. Perform excavation and backfill required for work of this Section.
   2. Furnish and install gas piping and fittings within building and from building to meter including connection to meter as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 23 0501 Common HVAC Requirements

C. Section 23 0533- Identification For HVAC Piping and Equipment

D. Section 23 0516 - Expansion Fittings and Loops for HVAC Piping.

E. Section 33 5216 - Gas Hydrocarbon Piping.

### 1.04 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.

B. ASME B31.9 - Building Services Piping 2020.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

F. Project Record Documents: Record actual locations of valves.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Valve Repacking Kits: One for each type and size of valve.

### 1.06 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

**1.08 FIELD CONDITIONS**

A. Do not install underground piping when bedding is wet or frozen.

**PART 2 PRODUCTS**

**2.01 GENERAL MANUFACTURERS:**

A. Manufacturer Contact List:
   1. BrassCraft; www.brasscraft.com.
   2. Cimberio Valve Co Inc; www.cimberio.com.
   3. ConBraCo Industries, Inc; www.conbraco.com;(416) 293-8111.
   4. Dormont Manufacturing Company; www.dormont.com.
   5. Jenkins-NH-Canada; www.jenkins-nh-canada.com.
   6. Jomar International; www.jomar.com.
   7. California Valves (formally KOSO) by Pacific Seismic Products Inc; Distributed by Strand Earthquake Consultants www.strandearthquake.net.
   8. Viega LLC; www.viega.com.
   9. Watts Regulator Co; www.wattsreg.com; (888) 208-8927.

**2.02 MATERIALS:**

A. Above-Ground Pipe:
   1. Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of A53/A53M.

B. Above-Ground Pipe Fittings:
   1. Welded forged steel fittings meeting requirements of ASTM A234/A234M.
   2. Standard weight malleable iron screwed.
   3. Viega MegaPressG fittings.

C. Below-Ground Pipe And Fittings: Polyethylene pipe and fittings meeting requirements of ASTM D2513 with No. 14 coated copper trace wire.

D. Valves:
   1. 125 psi (862 kPa) bronze body ball valve, UL listed.
   2. Approved Products.
      a. CIM 102.1 by Cimbrio Valve.
      b. Apollo Series 80-100 by ConBraCo.
      c. 'Red Cap' R602 by Jenkins NH Canada.
      d. Model T-204 by Jomar International.
      e. Model B-6000-UL by Watts Regulator.

E. Cocks:
   1. Gauge Cocks: Conbraco Series 50-56 bronze gauge cock.

F. Flexible Connector:
   1. Type 304 stainless steel corrugated tube coated for corrosion protection.
   2. Approved Products.
      a. Dormont Supr-Safe.
      b. BrassCraft Procoat.

G. Seismic Valves:
   1. Natural gas seismic shut-off valves.

a. Rate at maximum 20 psi (138 kPA) pressure with positive seating from minus 40 deg F to plus 150 deg F (minus 40 deg C to plus 66 deg C) for exterior mounting near gas meter.
b. UL listed valve, factory set for IBC Seismic Design Category D, E, or F.
c. Size to be determined by total cu ft (0.028 cu m) per hour gas flow requirement of building and following conditions: 0.1 inch (2.54 mm) water column maximum allowable pressure-drop through valve with available pressure of 4 oz (113 grams).
d. Approved Product.
    1) California Seismic Gas Shutoff Valve (formally KOSO):
        (a) Horizontal installation: Model 314F or 315F.
        (b) Vertical installation with bottom inlet: Model VB314F or VB315F.

**2.03 PIPE HANGERS AND SUPPORTS**

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.
5. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
    a. Bases: High density polypropylene.
    b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
    c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
    d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
    e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
    f. Manufacturers:
        1) PHP Systems/Design: www.phpsd.com/#sle.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that excavations are to required grade, dry, and not over-excavated.

**3.02 PREPARATION**

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

**3.03 INSTALLATION**

A. Steel pipe installed through air plenums, in walls:
1. Pipes 2-1/2 inches (64 mm) and larger shall have welded fittings and joints.
2. Other steel pipe may have screwed or welded fittings.
3. Viega MegaPressG:
    a. Install MegaPressG fittings according to manufacturer’s recommendations and with manufacturer’s recommended tools.

B. Lay underground pipe in accordance with manufacturer's recommendations and local gas utility company regulations and specifications.
1. Provide 24 inch (610 mm) minimum steel pipe between vertical rise of riser and end of polyethylene line if anode-less riser is not used. Use plastic-to-steel transition or

compression fitting between end of polyethylene line and steel meter riser. Provide cathodic protection for steel riser or use anode-less riser.
2. Place tracer wire along side of polyethylene pipe from meter to point where pipe rises inside building.
3. Place 4 inches (100 mm) of sand around gas line buried underground.
4. Do not install gas piping under building floor slabs-on-grade.

C. After gas meter, valves, seismic valve and etc, gas piping should rise inside outside wall and not be visible to public.

D. On lines serving gas-fired equipment, install gas cocks adjacent to equipment outside of equipment cabinet and easily accessible.

E. Install 6 inch (150 mm) long minimum dirt leg, with pipe cap, on vertical gas drop serving each gas-fired equipment unit.

F. Use fittings for changes of direction in pipe and for branch runouts.

G. Visible gas piping inside building shall be painted yellow and labeled.

H. Install seismic valve in 24 inch (610 mm) long pipe section anchored to building wall at each end.

I. Install in accordance with manufacturer's instructions.

J. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

K. Route piping in an orderly manner and maintain gradient. Route parallel and perpendicular to walls.

L. Install piping to maintain headroom, conserve space, and not interfere with use of space.

M. Group piping whenever practical at common elevations.

N. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.

O. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

P. Provide access where valves and fittings are not exposed.
1. Coordinate size and location of access doors with Section 08 3100.

Q. Establish elevations of buried piping outside the building to ensure not less than 2.5 ft of cover.

R. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

S. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

T. Provide support for utility meters in accordance with requirements of utility companies.

U. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

V. Install valves with stems upright or horizontal, not inverted.

W. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

X. Sleeve pipes passing through partitions, walls and floors.

Y. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

## 3.04 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 5216. Gas service distribution piping to have initial minimum pressure of 7 inch wg.

## 3.05 FIELD QUALITY CONTROL

A. Field tests:
   1. Subject all portions of gas piping system, in sections or in entirety, to air pressure of 75 psig (0.52 MPa) and prove airtight for four (4) hours.
   2. Disconnect equipment not suitable for 75 psig (0.52 MPa) pressure from piping system during test period.

**END OF SECTION**

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**SECTION 23 2300**
**REFRIGERANT PIPING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators. [Sight Glass]
D. Valves.
E. Strainers.
F. Check valves.
G. Pressure regulators.
H. Pressure relief valves.
I. Filter-driers.
J. Solenoid valves.
K. Receivers.
L. Flexible connections.

### 1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.

### 1.03 DEFINITIONS:

A. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
B. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

### 1.04 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.
B. Section 09 9123 - Interior Painting.
C. Section 23 0716 - HVAC Equipment Insulation.
D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

### 1.05 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers 2005.
B. AHRI 710 (I-P) - Performance Rating of Liquid-Line Driers 2009.
C. AHRI 711 (SI) - Performance Rating of Liquid-Line Driers 2009.
D. AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers 2013 (Reapproved 2014).
E. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.
F. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants 2019.
G. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

J. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2020.

K. ASME B31.9 - Building Services Piping 2020.

L. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

M. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

P. UL 429 - Electrically Operated Valves Current Edition, Including All Revisions.

### 1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Design Data: Submit design data indicating pipe sizing. Indicate load-carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of leak test, acid test.

F. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

G. Submit welders certification of compliance with ASME BPVC-IX.

H. Designer's qualification statement.

I. Installer's qualification statement.

J. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

K. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

### 1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of documented experience.

### 1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

## PART 2 PRODUCTS

### 2.01 SYSTEM DESCRIPTION

A. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

## 2.02 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

## 2.03 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58.
      a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Vertical Support: Steel riser clamp.
   7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   8. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   9. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## 2.04 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 700.

B. Refrigerant: R-32, difluoromethane (methylene fluoride) as defined in ASHRAE Std 34.

C. Refrigerant: R-454b, 68.9 percent difluoromethane (R-32), and 31.1 percent 2,3,3,3-tetrafluoropropene (R-1234yf), a hydrofluoroolefin. as defined in ASHRAE Std 34.

## 2.05 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Henry Technologies: www.henrytech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

## 2.06 VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Henry Technologies: www.henrytech.com/#sle.
   3. Flomatic Valves: www.flomatic.com/#sle.

B. Diaphragm Packless Valves:

1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, soldered or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Packed Angle Valves:
   1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, soldered or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

D. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

E. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

## 2.07 STRAINERS

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

C. Straight Line, Noncleanable Type:
   1. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of 500 psi.

## 2.08 CHECK VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Globe Type:
   1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

C. Straight Through Type:
   1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

## 2.09 PRESSURE REGULATORS

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

## 2.10 PRESSURE RELIEF VALVES

A. Manufacturers:

1. Hansen Technologies Corporation: www.hantech.com/#sle.
2. Henry Technologies: www.henrytech.com/#sle.
3. Sherwood Valve/Harsco Corporation: www.sherwoodvalve.com/#sle.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi.

## 2.11 FILTER-DRIERS

A. Manufacturers:
1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Performance:
1. Flow Capacity - Liquid Line: 5 ton, minimum, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).
2. Flow Capacity - Suction Line: 5 ton, minimum, rated in accordance with AHRI 730 (I-P).
3. Water Capacity: As indicated in schedule, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).
4. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
5. Design Working Pressure: 350 psi, minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.
1. Replaceable Core Type: Steel shell with removable cap.
2. Sealed Type: Copper shell.
3. Connections: As specified for applicable pipe type.

## 2.12 SOLENOID VALVES

A. Manufacturers:
1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, soldered, or threaded ends; for maximum working pressure of 500 psi.

C. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

## 2.13 RECEIVERS

A. Manufacturers:
1. Henry Technologies: www.henrytech.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sherwood Valve/Harsco Corporation: www.sherwoodvalve.com/#sle.

B. Internal Diameter 6 inch and Smaller:
1. AHRI 495, UL listed, steel, brazed; 400 psi maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.

C. Internal Diameter Over 6 inch:

1. AHRI 495, welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; 400 psi with tappings for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

### 2.14 FLEXIBLE CONNECTORS

A. Manufacturers:
   1. Circuit Hydraulics, Ltd: www.circuit-hydraulics.co.uk/#sle.
   2. Flexicraft Industries: www.flexicraft.com/#sle.
   3. Penflex: www.penflex.com/#sle.

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain-end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

### 3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping or isolate from other metals

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.

J. Flood piping system with nitrogen when brazing.

K. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

L. Prepare unfinished pipe, fittings, supports, and accessories for finish painting. See Section 09 9123.

M. Insulate piping and equipment.

N. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

O. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

P. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

Q. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

R. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

S. Fully charge completed system with refrigerant after testing.

T. Provide electrical connection to solenoid valves. See Section 26 0583.

**3.03 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 400–600 psi, per manufacturer specifications. Perform final evacuation to 500 microns or lower. Test and repair piping until no leakage is detected using electronic leak detector rated for A2L refrigerants or approved bubble solution.

D. Field Tests:

1. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
    a. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 500 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
    b. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 500 microns without vacuum pump running.
    c. Conduct tests at 70 deg F (21 deg C) ambient temperature minimum.
    d. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
    e. After testing, fully charge system with refrigerant and conduct test with electronic leak detector rated for A2L refrigerants or approved bubble solution.
    f. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

**3.04 NON-CONFORMING WORK:**

A. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

**END OF SECTION**

**SECTION 23 3100**
**HVAC DUCTS AND CASINGS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

### 1.02 RELATED REQUIREMENTS

A. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC Section 01 4546 Duct Testing, Adjusting, and Balance

B. Section 23 0713 - Duct Insulation: External insulation and duct liner.

C. Section 23 3300 - Air Duct Accessories.

D. Section 23 3700 - Air Outlets and Inlets: Fabric air distribution devices.

### 1.03 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 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.

### 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, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

### 1.05 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 3319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Use rectangular or round galvanized steel ductwork suitable for low to medium pressure systems (≤2 inches w.g.). Duct construction shall comply with SMACNA standards for low-pressure systems unless otherwise specified.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Seal ducts to meet SMACNA Seal Class A for all supply and return ducts. Duct leakage shall not exceed 4 CFM per 100 ft² of duct surface area at 1 inch w.g., tested in accordance with SMACNA Duct Leakage Test Manual and ASHRAE 90.1.Duct Fabrication Requirements:

2. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
4. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
5. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
7. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
8. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

## 2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
3. Manufacturers and Approved Products:
   a. Carlisle HVAC Products; Hardcast Iron-Grip 601 Water Based Duct Sealant: www.carlislehvac.com/#sle.
   b. Duct Butter or ButterTak by Cain Manufacturing Co Inc, Pelham, AL www.cainmfg.com.
   c. DP 1010, DP 1030 or DP 1015 by Design Polymerics, Fountain Valley, CA www.designpoly.com.
   d. PROseal, FIBERseal, EVERseal, or EZ-seal by Ductmate Industries, Inc., Charleroi, PA www.ductmate.com.
   e. SAS by Duro Dyne, Bay Shore, NY or Duro Dyne Canada, Lachine, QB www.durodyne.com.
   f. Iron Grip 601 by Hardcast Inc, Wylie, TX www.hardcast.com.
   g. MTS100 or MTS 200 by Hercules Mighty Tough, Denver CO, www.herculesindustries.com.
   h. 15-325 by Miracle / Kingco, Div ITW TACC, Rockland, MA www.taccint.com.
   i. 44-39 by Mon-Eco Industries Inc, East Brunswick, NJ www.mon-ecoindustries.com.
   j. Airseal Zero by Polymer Adhesive Sealant Systems Inc, Weatherford, TX www.polymeradhesives.com.
   k. Airseal #22 Water Base Duct Sealer by Polymer Adhesive Sealant Systems Inc, Weatherford, TX, www.polymeradhesives.com

## 2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated in contract documents.

B. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

## 2.04 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Flexible Ducts: 2 layer black polymer film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: Minus 20 degrees F to 175 degrees F.
   5. Manufacturers:
      a. JP Lamborn Co., Fresno CA www.jplflex.com.
      b. Flexmaster USA Inc, Houston, TX www.flexmasterusa.com or Flexmaster Canada Ltd, Richmond Hill, ON (905) 731-9411.
      c. Thermaflex by Flexible Technologies, Abbeville, SC or Mississauga, ON www.thermaflex.net.
   6. Products
      a. PR-25 by JP Lamborn.
      b. Flex-Vent KP by Thermaflex by Flexible Technologies.
      c. Type 1B Insulated by Flexmaster

C. Cinch/Draw Bands: Nylon, 3/8 inch (9.5 mm) removable and reusable type
   1. Listed and labeled in accordance with Standard UL 181B and labeled 'UL 181 B-C'.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

C. Flexible Ducts: Connect to metal ducts with draw bands.
   1. Install duct in fully extended condition free of sags and kinks, using 72 inch (1 800 mm) maximum lengths.
   2. Make duct connections by coating exterior of duct collar for 3 inches (75 mm) with duct sealer and securing duct in place over sheet metal collar with specified draw/cinch bands.

D. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

**END OF SECTION**

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**SECTION 23 3300**
**AIR DUCT ACCESSORIES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Duct access doors.

B. Duct test holes.

C. Flexible duct connectors.

D. Volume control dampers.

E. Low leakage (Class 1A) control dampers.

F. Miscellaneous products:

G. Acoustical Liner System
   1. Fasteners

H. Flexible Equipment Connections

I. Dampers and Damper Accessories
   1. Duct opening closure film.
   2. Concealed Ceiling Damper Regulators
   3. Dampers
      a. Bypass dampers
      b. Motorized Outside Air Dampers
      c. Motorized Zone Dampers
      d. Volume Dampers

J. Air Turns

K. Branch Tap for Flexible Ductwork

### 1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

### 1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

## PART 2 PRODUCTS

### 2.01 MANUFACTURES

A. AGM Industries, Brockton, MA www.agmind.com.

B. Air Balance Inc, Holland, OH www.airbalance.com.

C. Air Filters Inc, Baltimore, MD www.afinc.com.

D. Air-Rite Manufacturing, Bountiful, UT (801) 295-2529.

E. American Warming & Ventilating, Holland, OH www.american-warming.com.

F. Arrow United Industries, Wyalusing, PA www.arrowunited.com.

G. Cain Manufacturing Company Inc, Pelham, AL www.cainmfg.com.

H. C & S Air Products, Fort Worth, TX www.csairproducts.com.

I. CertainTeed Corp, Valley Forge, PA www.certainteed.com.

J. Cesco Products, Florence, KY www.cescoproducts.com.

K. Daniel Manufacturing, Ogden, UT (801) 622-5924.
L. Design Polymerics, Fountain Valley, CA www.designpoly.com.
M. Ductmate Industries Inc, East Charleroi, PA www.ductmate.com.
N. Duro Dyne, Bay Shore, NY www.durodyne.com.
O. Dyn Air Inc. Lachine, QB www.dynair.ca
P. Elgen Manufacturing Company, Inc. East Rutherford, NJ www.elgenmfg.com
Q. Flexmaster USA Inc, Houston, TX www.flexmasterusa.com.
R. Greenheck Corp, Schofield, WI www.greenheck.com.
S. Gripnail Corp, East Providence, RI www.gripnail.com.
T. Hardcast Inc, Wylie, TX www.hardcast.com.
U. Hercules Industries, Denver, CO, www.herculesindustries.com.
V. Honeywell Inc, Minneapolis, MN www.honeywell.com.
W. Industrial Acoustics Co, Bronx, NY www.industrialacoustics.com.
X. Johns-Manville, Denver, CO www.jm.com.
Y. Kees Inc, Elkhart Lake, WI www.kees.com.
Z. Knauf Fiber Glass, Shelbyville, IN www.knauffiberglass.com.
AA. Manson Insulation Inc, Brossard, QB www.isolationmanson.com.
BB. Metco Inc, Salt Lake City, UT (801) 467-1572 www.metcospiral.com.
CC. Miracle / Kingco, Rockland, MA www.taccint.com.
DD. Mon-Eco Industries Inc, East Brunswick, NJ www.mon-ecoindustries.com.
EE. Nailor Industries Inc, Houston, TX www.nailor.com.
FF. Owens Corning, Toledo, OH www.owenscorning.com.
GG. Polymer Adhesive Sealant Systems Inc, Irving, TX www.polymeradhesives.com.
HH. Pottorff Company, Fort Worth, TX www.pottorff.com.
II. Ruskin Manufacturing, Kansas City, MO www.ruskin.com.
JJ. Sheet Metal Connectors Inc, Minneapolis, MN www.smconnectors.com.
KK. Tamco, Stittsville, ON www.tamco.ca.
LL. Techno Adhesive, Cincinnati, OH www.technoadhesives.com.
MM. Titus, Richardson, TX (972) 699-1030. www.titus-hvac.com
NN. McGill AirSeal, Columbus, OH www.mcgillairseal.com.
OO. United Enertech Corp, Chattanooga, TN www.unitedenertech.com.
PP. Utemp Inc, Salt Lake City, UT (801) 978-9265.
QQ. Ventfabrics Inc, Chicago, IL www.ventfabrics.com.
RR. Ward Industries, Grand Rapids MI www.wardind.com.
SS. Young Regulator Co, Cleveland, OH www.youngregulator.com

**2.02 ACOUSTICAL LINER SYSTEM:**

A. Duct Liner:
1. One inch (25 mm) thick, 1-1/2 lb (0.68 kg) density fiberglass conforming to requirements of ASTM C1071. Liner will not support microbial growth when tested in accordance with ASTM C1338.
2. Approved Products.
a. ToughGard by CertainTeed.

b. Duct Liner E-M by Knauf Fiber Glass.
c. Akousti-Liner by Manson Insulation.
d. Quiet R by Owens Corning.
e. Linacoustic RC by Johns-Manville.

B. Adhesive:
1. For indoor applications:
a. Provide adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Approved Water-Based Products.
a. Cain: Hydrotak.
b. Design Polymerics: DP2501 or DP2502 (CMCL-2501).
c. Duro Dyne: WSA.
d. Elgen: A-410-WB.
e. Hardcast: Coil-Tack.
f. Hercules: Mighty Tough Adhesives MTA500 or MTA600.
g. Miracle / Kingco: PF-101.
h. Mon-Eco: 22-67 or 22-76.
i. Polymer Adhesive: Glasstack #35.
j. Techno Adhesive: 133.
k. McGill AirSeal: Uni-tack.
3. Approved Solvent-Based (non-flammable) Products.
a. Cain: Safetak.
b. Duro Dyne: FPG.
c. Hardcast: Glas-Grip 648-NFSE.
d. Miracle / Kingco: PF-91.
e. Mon-Eco: 22-24.
f. Polymer Adhesive: Q-Tack.
g. Techno Adhesive: 'Non-Flam' 106.
4. Approved Solvent-Based (flammable) Products.
a. Cain: HV200.
b. Duro Dyne: MPG.
c. Hardcast: Glas-Grip 636-SE.
d. Miracle / Kingco: PF-96.
e. Mon-Eco: 22-22.
f. Polymer Adhesive: R-Tack.
g. Techno Adhesive: 'Flammable' 106.

C. Fasteners:
1. Adhesively secured fasteners are not allowed.

D. Approved Products.
1. AGM Industries: 'DynaPoint' Series RP-9 pin.
2. Cain.
3. Duro Dyne.
4. Gripnail: May be used if each nail is installed by 'Grip Nail Air Hammer' or by 'Automatic Fastener Equipment' in accordance with manufacturer's recommendations.

**2.03 BACKDRAFT DAMPERS**

A. Backdraft Dampers: Factory-fabricated.
1. Backdraft blades shall be nonmetallic neoprene coated fiberglass type.
2. Stop shall be galvanized steel screen or expanded metal, 1/2 inch (13 mm) mesh.
3. Frame shall be galvanized steel or extruded aluminum alloy.
4. Approved Products.
a. Air-Rite: Model BDD-3.

b. American Warming: BD-15.
c. C & S: BD30.
d. Pottorff: BD-51.
e. Ruskin: NMS2.
f. Utemp: BFEA.

**2.04 LOCKING QUADRANT DAMPER REGULATORS:**

A. Approved Products. See Section 01 6200 for definitions of Categories:
1. Duro Dyne: KS-385.
2. Dyn Air: QPS-385.
3. Elgen: EQR-4.
4. Ventfabrics: Ventline 555.
5. Young: No. 1.

**2.05 CONCEALED CEILING DAMPER REGULATORS:**

A. Approved Products.
1. Cain.
2. Duro Dyne.
3. Elgen.
4. Metco Inc.
5. Ventfabrics: 666 Ventlok.
6. Young: 301.

**2.06 VOLUME DAMPERS:**

A. Rectangular Duct:
1. Factory-manufactured 16 ga (1.6 mm) galvanized steel, single blade and opposed blade type with 3/8 inch (9.5 mm) axles and end bearings. Blade width 8 inches (200 mm) maximum. Blades shall have 1/8 inch (3 mm) clearance all around.
2. Damper shall operate within acoustical duct liner.
3. Provide channel spacer equal to thickness of duct liner.
4. Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
5. Approved Products.
a. Air-Rite: Model CD-2.
b. American Warming: VC-2-AA.
c. Arrow: OBDAF-207.
d. C & S: AC40.
e. Cesco: AGO.
f. Daniel: CD-OB.
g. Greenheck: VCD-20.
h. Nailor: 1810 or 1820.
i. Pottorff: CD-42.
j. Ruskin: MD-35.
k. United Enertech: MD-115.
l. Utemp: CD-OB.

B. Round Duct:
1. Factory-manufactured 20 ga (1.0 mm) galvanized steel, single blade with 3/8 inch (9.5 mm) axles and end bearings.
2. For use in outside air ducts.
3. Approved Products.
a. Air Balance: Model AC-22.
b. Air-Rite: Model CD-8.
c. American Warming: V-22.

d. Arrow: Type-70.
e. C & S: AC21R.
f. Cesco: MGG.
g. Nailor: 1890.
h. Pottorff: CD-21R.
i. Ruskin: MDRS-25.
j. United Enertech: RD.

**2.07 MOTORIZED OUTSIDE AIR DAMPERS**

A. General:
1. Low leakage type. AMCA certified.
2. Make provision for damper actuators and actuator linkages to be mounted external of air flow.

B. Rectangular Ducts:
1. Damper Blades:
a. Steel or aluminum airfoil type with mechanically locked blade seals, 8 inch (200 mm) blade width maximum measured perpendicular to axis of damper.
2. Jamb seals shall be flexible metal compression type.
3. Opposed or single blade type.
4. Approved Products.
a. Air Balance: AC 526.
b. American Warming: AC526.
c. Arrow: AFD-20.
d. C & S: AC50.
e. Cesco: AGO3.
f. Nailor: 2020.
g. Pottorff: CD-52.
h. Ruskin: CD-60.
i. Tamco: Series 1000.
j. United Enertech: CD-150 or CD-160.

C. Round Ducts:
1. Damper Blades:
a. Steel with mechanically locked blade seals.
b. Blade seals shall be neoprene or polyethylene.
2. Single blade type.
3. Approved Products.
a. Air Balance: AC 25.
b. American Warming: VC25.
c. Arrow: Type 70 or 75.
d. C & S: AC25R.
e. Cesco: AGG.
f. Nailor: 1090.
g. Pottorff: CD-25R.
h. Ruskin: CD25.
i. Tamco: Square-to-Round Series 1000.
j. United Enertech: RI.

**2.08 MOTORIZED ZONE DAMPERS: (FOR USE WITH SPECIFIED ZONING PANEL):**

A. Approved Product.
1. Honeywell Dampers (round) ARD(size)TZ.
2. Honeywell Dampers (rectangular) ZD(size x size)TZ.

**2.09 BYPASS DAMPER:**

A. Approved Product.
   1. Honeywell CPRD (size) from 8 inch to 14 inch.

**2.10 BACKDRAFT DAMPERS:**

A. Backdraft blades shall be nonmetallic neoprene coated fiberglass type.

B. Stop shall be galvanized steel screen or expanded metal, 1/2 inch (13 mm) mesh.

C. Frame shall be galvanized steel or extruded aluminum alloy.

D. Approved Products.
   1. Air-Rite: Model BDD-3.
   2. American Warming: BD-15.
   3. C & S: BD30.
   4. Pottorff: BD-51.
   5. Ruskin: NMS2.
   6. Utemp: BFEA.

**2.11 AIR TURNS:**

A. Single thickness vanes. Double thickness vanes not acceptable.

B. 4-1/2 inch (115 mm) wide vane rail. Junior vane rail not acceptable.

**2.12 BRANCH TAP FOR FLEXIBLE DUCTWORK:**

A. Factory-manufactured rectangular-to-round 45 degree leading tap fabricated of 24 ga (0.635 mm) zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A653, with G-90 coating.

B. One inch wide mounting flange with die formed corner clips, pre-punched mounting holes, and adhesive coated gasket.

C. Manual Volume Damper:
   1. Single blade, 22 ga (0.79 mm) minimum
   2. 3/8 inch (9.5 mm) minimum square rod with brass damper bearings at each end.
   3. Heavy-duty locking quadrant on 1-1/2 inch (38 mm) high stand-off mounting bracket attached to side of round duct.

D. Approved Products.
   1. ST-1HD by Air-Rite:
   2. Nylon damper bearings approved for Air-Rite.
   3. STO by Flexmaster.
   4. HET by Sheet Metal Connectors

**2.13 DUCT ACCESS DOORS**

A. General:
   1. Factory built insulated access door with hinges and sash locks, as necessary. Construction shall be galvanized sheet metal, 24 ga (0.635 mm) minimum.
   2. Fire and smoke damper access doors shall have minimum clear opening of 12 inches (300 mm) square or larger as shown on Drawings.

B. Rectangular Ducts:
   1. Approved Products.
      a. Air Balance: Fire/Seal FSA 100.
      b. Air-Rite: Model HAD-2.
      c. Cesco: HDD.
      d. Elgen: TAB Type / Hinge and Cam.
      e. Flexmaster: Spin Door.
      f. Kees: ADH-D.
      g. Nailor: 08SH.
      h. Pottorff: 60-HAD.

i. Ruskin: ADH-24.
j. United Enertech: L-95.

C. Round Ducts:
1. Approved Products.
a. Ductmate: 'Sandwich' Access Door.
b. Elgen: Sandwich Access Door.
c. Kees: ADL-R.
d. Nailor: 0809.
e. Pottorff: RAD.
f. Ruskin: ADR.
g. Ward: DSA.

## 2.14 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

## 2.15 FLEXIBLE EQUIPMENT DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

C. Approved Products
1. Cain: N-100.
2. Duro Dyne: MFN.
3. Dyn Air: CPN with G-90 galvanized off-set seam.
4. Elgen: ZLN / SDN.
5. Ventfabrics: Ventglas.
6. Ductmate: ProFlex.

## 2.16 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
1. Thickness: 2 mils, minimum
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.

B. Duct Hangers:
1. One inch (25 mm) by 18 ga (1.27 mm) galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches (2 400 mm) apart. Do not use wire hangers.
2. Attaching screws at trusses shall be 2 inch (50 mm) No. 10 round head wood screws. Nails not allowed.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Furnish and install acoustic lining in following types of rectangular ducts unless noted otherwise on Contract Documents:
1. Supply air.
2. Return air.
3. Mixed air.
4. Transfer air.

5. Relief air.
6. Exhaust air.
7. Elbows, fittings, and diffuser drops greater than 12 inches (300 mm) in length.

B. Do not install acoustic lining in round ducts.

C. Flexible Connections: Install flexible inlet and outlet duct connections to each furnace.

D. Access Doors In Ducts:
1. Install at each manual outside air damper and at each motorized damper. Locate doors within 6 inches (150 mm) of installed dampers.
2. Install within 6 inches (150 mm) of fire dampers and in Mechanical Room if possible. Install on side of duct that allows easiest access to damper.

E. Dampers And Damper Accessories:
1. Install concealed ceiling damper regulators.
2. Paint cover plates to match ceiling tile.
3. Do not install damper regulators for dampers located directly above removable ceilings or in Mechanical Rooms.
4. Provide each take-off with an adjustable volume damper to balance that branch.
5. Anchor dampers securely to duct.
6. Install dampers in main ducts within insulation.
7. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
8. Where concealed ceiling damper regulators are installed, provide cover plate.
9. Install motorized dampers.
10. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 3100 for duct construction and pressure class.
11. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

F. Provide duct test holes where indicated and required for testing and balancing purposes.

G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

**END OF SECTION**

**SECTION 23 3423**
**HVAC POWER VENTILATORS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Cabinet exhaust fans.

### 1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install exhaust fans as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. Section 23 3100 HVAC DUCTS and Casings

B. Section 23 0548 - Vibration and Seismic Controls for HVAC.

C. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

### 1.04 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.

B. AMCA 99 - Standards Handbook 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

G. UL 705 - Power Ventilators Current Edition, Including All Revisions.

### 1.05 FIELD CONDITIONS

A. Request Owner permission to use permanent ventilator(s) for ventilation during construction.

## PART 2 PRODUCTS

### 2.01 CABINET EXHAUST FANS

A. Manufacturers:
   1. Acme Engineering & Manufacturing Corp, Muskogee, OK www.acmefan.com.
   2. Broan-Nu Tone LLC, Harford, WI www.broan.com.
   3. Carnes Co., Verona, MI www.carnes.com.
   4. Loren Cook Co., Springfield, MO www.lorencook.com.
   5. Soler & Palau (S&P USA Ventilation Systems, LLC), Jacksonville FL www.solerpalau-usa.com.

B. Ceiling Mounted Exhaust Fans:
   1. Acoustically insulated housings. Sound level rating of 5.0 sones maximum for CFM and static pressure listed on Contract Drawings.
   2. Include chatterproof integral back-draft damper with no metal-to-metal contact.
   3. True centrifugal wheels.
   4. Entire fan, motor, and wheel assembly shall be easily removable without disturbing housing.
   5. Suitably ground motors and mount on rubber-in shear vibration isolators.
   6. Provide wall or roof cap, as required.
   7. Acceptable Products
      a. Acme: VQ.
      b. Broan: LoSone.
      c. Carnes: VCD.

d. Cook: Gemini.
e. Soler & Palau: FF.

C. Grille: Molded white plastic.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 0548.
2. Install flexible connections between fan and ductwork; see Section 23 3300. Ensure metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

C. Install backdraft dampers on all outside outlets.

D. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans.

**END OF SECTION**

**SECTION 23 3700**
**AIR OUTLETS AND INLETS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Registers/grilles/diffusers.

B. Louvers.

### 1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install diffusers, registers, and grilles connected to ductwork as described in Contract Documents.
   2. Furnish and install louvers connected to ductwork as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

B. Section 23. 3100 HVAC ducts and casings.

### 1.04 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2012 (Reapproved 2015).

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets 2006 (Reaffirmed 2021).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2021.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

H. UL 2518 - Standard for Safety Air Dispersion Systems Current Edition, Including All Revisions.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Samples: Submit two of each required air outlet and inlet type.

D. Project Record Documents: Record actual locations of air outlets and inlets.

### 1.06 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Krueger-HVAC: www.krueger-hvac.com/#sle.

C. Metalaire, a brand of Metal Industries Inc: www.metalaire.com/#sle.

D. Price Industries: www.price-hvac.com/#sle.

E. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

F. Tuttle and Bailey: www.tuttleandbailey.com/#sle.

**2.02 CEILING DIFFUSERS**

A. Finish: Off-white baked enamel.

B. Approved Products
   1. Carnes: SKSA.
   2. J & J: R-1400.
   3. Krueger: SH.
   4. Metal*Aire: 5500S.
   5. Nailor: 65OOB.
   6. Price: SMD-6.
   7. Titus: TDC-6.
   8. Tuttle & Bailey: M.

**2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES**

A. Finish: Off-white baked enamel.

B. 1/2 inch (12.7 mm) spacing.

C. See Contract Documents for location of filter grilles.

D. Approved Products
   1. Carnes: RSLA.
   2. J & J: S90H.
   3. Krueger: S85H.
   4. Metal*Aire: SRH.
   5. Nailor: 6155H.
   6. Price: 535.
   7. Titus: 355RL or 355 RS.
   8. Tuttle & Bailey: T75D.

**2.04 SIDEWALL SUPPLY REGISTERS/GRILLES**

A. Finish: Off-white baked enamel.

B. Removable core.

C. Double deflection.

D. Set sidewall supply register blades at 15 degrees upward deflection

E. Approved Products
   1. Krueger: 5815.
   2. Metal*Aire: 42C.
   3. Nailor: 51RCD.
   4. Price: RCG-DVS.
   5. Titus: 1707.
   6. Tuttle & Bailey: AVF.

**2.05 LOW SIDEWALL RETURN GRILLS**

A. Finish: Off-white baked enamel.

B. 38 or 45 degree deflection.

C. Approved Products
   1. Carnes: RSHA.
   2. J & J: S-590.

3. Krueger: S480H.
4. Metal*Aire: HD-RH.
5. Nailor: 6145H-HD.
6. Price: 91.
7. Titus: 33RL or 33RS.
8. Tuttle & Bailey: T115D.

**2.06 SOFFIT GRILLES:**

A. Finish: Baked enamel. Match soffit color.

B. Aluminum with aluminum mesh insect screen.

C. Approved Products
1. Carnes: RAAA.
2. J & J: ALS95H.
3. Krueger: S585H.
4. Metal*Aire: RHE.
5. Nailor: 5155-IS.
6. Price: 635.
7. Titus: 355FL.
8. Tuttle & Bailey: A75D.

**2.07 LOUVERS**

A. Manufacturers:
1. Airolite Co, Marietta, OH www.airolite.com.
2. Air-Rite Manufacturing, Bountiful, UT www.air-ritemfg.com.
3. American Warming & Ventilating, Holland, OH www.awv.com.
4. Arrow United Industries, Wyalusing, PA www.arrowunited.com.
5. Carnes Co, Verona, WI www.carnes.com or Energy Technology Products LTD, Edmonton, AB (780) 468-1110.
6. Industrial Louvers Inc, Delano, MN www.industriallouvers.com or DKG Construction, LTD., Waterdown, ON 289-895-9729.
7. Pottorff, Fort Worth, TX www.pottorff.com.
8. Ruskin Manufacturing, Kansas City. MO www.ruskin.com.
9. United Enertech Corporation, Chattanooga, TN www.unitedenertech.com.
10. Vent Products Co Inc, Chicago, IL www.ventprod.com.
11. SF435 by Western Ventilation Products Ltd, Calgary, AB www.westvent.com.
12. Wonder Metals Corp, Redding, CA www.wondermetals.com.

B. General:
1. Extruded aluminum, with blades welded or screwed into frames.
2. Frames shall have mitered corners.
3. Louvers shall be recessed, flanged, stationary, or removable as noted on Contract Documents.

C. Finish:
1. Polyvinyledene Fluoride ($PVF_2$) Resin-base finish (Kynar 500 or Hylar 5000) containing 70 percent minimum $PVF_2$ in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
2. Color as selected by Architect from Manufacturer's standard colors.

D. Louvers Connected To Ductwork:
1. 1/2 inch (13 mm) mesh 16 ga (1.59 mm) aluminum bird screen.
2. Approved Products:
a. K638 by Airolite.
b. LE-1 by Air-Rite Manufacturing.

c. LE48 by American Warming & Ventilating.
d. EA-405 by Arrow United Industries.
e. FKDA by Carnes.
f. 455-XP by Industrial Louvers.
g. EFK-445 by Pottorff.
h. ELF81S30 by Ruskin.
i. EL-4 by United Enertech.
j. 2740-31 by Vent Products.
k. EX by Wonder Metals.

E. Architectural Louvers:
1. Aluminum bug screen.
2. Approved Products:
a. T608 by Airolite.
b. LE57 by American Warming & Ventilating.
c. EFJ-245 by Pottorff.
d. EL-2 by United Enertech.
e. Equals by Arrow United Industries, Carnes, or Industrial Louvers as approved by Architect before installation.
3. Anchor securely into openings.
4. Where louvers touch masonry or dissimilar metals, protect with heavy coat of asphaltum paint.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Anchor all items securely

E. Louvers
1. Anchor securely into openings.
2. Where louvers touch masonry or dissimilar metals, protect with heavy coat of asphaltum paint.

F. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

G. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

H. Set sidewall supply register blades at 15 degrees upward deflection.

**END OF SECTION**

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# SECTION 23 4000
# HVAC AIR CLEANING DEVICES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Disposable panel filters.

### 1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install filters used in mechanical equipment.

### 1.03 REFERENCE STANDARDS

A. AHRI 851 (SI) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013.

B. UL 900 - Standard for Air Filter Units Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

### 1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

A. Comply with the rating requirements in AHRI 851 (SI).

### 2.02 GENERAL FILTER REQUIREMENTS

A. Furnace Filters: One inch (25 mm) thick throw-away type as recommended by Furnace Manufacturer. MERV 4 minimum.

B. Energy Recovery Units:
   1. Two inch (50 mm) thick pleated throw-away type as recommended by Energy Recovery Unit Manufacturer with ANSI/ASHRAE 52.2 MERV rating of 6 or higher.

### 2.03 DISPOSABLE PANEL FILTERS

A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
   1. Nominal Size: 24 by 24 inches.
   2. Thickness: 1 inch.

B. Performance Rating:
   1. Face Velocity: 500 fpm.
   2. Initial Resistance: 0.15 in-wc.
   3. Recommended Final Resistance: 0.50 in-wc.
   4. MERV 4 minimum

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Provide ample access for filter removal

C. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

E. **FIELD QUALITY CONTROL**

1. Inspection: At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

**END OF SECTION**

**SECTION 23 4114**
**SIDE-ACCESS HOUSING AND FILTERS**

## PART 1 GENERAL

### 1.01 INCLUDES BUT NOT LIMITED TO

A. Furnish and install housings with filters in specified ductwork as described in Contract Documents.

### 1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls: Filters for temporary heating and ventilating.

B. Section 23 0501 - Common Work Results for HVAC.

C. Section 23 3100 - HVAC Ducts and Casings.

### 1.03 REFERENCE STANDARDS

A. AHRI 851 (SI) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013.

B. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter; 1992.

C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

I. UL 900 - Standard for Air Filter Units Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Informational Submittals:
   1. Manufacturer Reports: Substantiating test reports on leakage from Manufacturer.

C. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, and connection requirements.

D. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and connection requirements.

E. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

F. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

## PART 2 PRODUCTS

### 2.01 FILTER MANUFACTURERS

A. The Camfil Group: www.camfilfarr.com/#sle.

B. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.

### 2.02 PERFORMANCE REQUIREMENTS

A. Comply with the rating requirements in AHRI 851 (SI).

B. Performance:
   1. Design Criteria:
      a. Leakage:
         1) At rated airflow, upstream to downstream of filter, holding frame and slide mechanism shall be less than one percent at 3 inch (76 mm) w.g. differential.
         2) Into housing frame ambient atmosphere at rated airflow shall be less than 0.5 percent at 3 inch (76 mm) w.g. negative.

C. Components:
   1. Filters:
      a. Pre-Filters:
         1) 2 inch (50 mm) medium efficiency, pleated, disposable type with non-woven cotton fabric media, media support grid, and enclosing frame.
         2) Capable of being installed or removed without disturbing seal on final filter.
      b. Final Filters: Media shall be synthetic microfiber, laminated to reinforcing backing to form lofted filter blanket with average efficiency of between 90 and 95 percent in accordance with ASHRAE Test Standard (52.1-92) and listed by UL as Class (2)(1).
      c. Approved Products:
         1) 3P Glide/Pack with 2 inch (50 mm) thick 30/30 pre-filters and 12 inch (300 mm) thick Camfil Riga Flo P95 final filter by Camfil Farr.
   2. Pressure Gauge:
      a. Magnehelic differential pressure gage capable of indicating minimum of 1-1/2 inches (38 mm) static pressure.
      b. Quality Standard: Dwyer 2000 Series.
   3. Insulation:
      a. Housing and access doors shall be double-wall with insulation between walls.
      b. Insulation shall be thermal, acoustical glass fiber, one inch (25 mm) thick with thermal conductivity of 0.25 to 0.30 K and bond strength of 20 PSF, based on S-08B modified. It shall withstand 250 deg F (121 deg C), meet hazard standards of NFPA 90A, and be tested in accordance with ASTM E84. Flame spread rating shall be 25 with a maximum smoke development of 50.

D. Fabrication:
   1. Housings:
      a. Fabrication of not less than 16-ga (1.6 mm) zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A653/A653M, with G-60 coating.
      b. Incorporate two access doors, extruded aluminum tracks, and individual holding frames for standard size, high efficiency, filter enclosing frame.
   2. Enclosing Frame: Fabricate of zinc-coated lock-forming quality steel, assembled so rigid and durable enclosure for filter pack is effected.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Brace and install housings so they will be free of vibration during operation. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Install filter gauge static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and level.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

E. Provide filter gauges on filter banks, installed with separate static pressure tips upstream and downstream of filters.

**END OF SECTION**

**SECTION 23 5400**
**FURNACES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Forced air furnaces.

B. Accessories

### 1.02 RELATED REQUIREMENTS

A. Section 23 0923.01 Direct-Digital Control System for HVAC

B. Section 22 3000 Plumbing Equipment [condensing gas water heaters]

C. Section 22 1005 Plumbing Piping [condensate piping]

### 1.03 SUMMARY

1. Includes But Not Limited To:
   a. Furnish and install horizontal/vertical gas-fired condensing furnaces as described in Contract Documents.

### 1.04 REFERENCE STANDARDS

A. ANSI Z21.47 - American National Standard for Gas-Fired Central Furnaces; 2021.

B. ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2022.

C. NFPA 54 - National Fuel Gas Code; 2021.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2019.

G. UL (DIR) - Online Certifications Directory; Current Edition.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Informational Submittals:
   1. Manufacturer Reports: Equipment check-out sheets.

C. Special Procedure Submittals:
   1. Installer must register with Manufacturer before submitting Manufacturer Warranty:
      a. Installer to contact Owner's Representative (FM Group or Project Manager) for following MANDATORY information to be given to Manufacturer before Manufacturer will issue Manufacturer's 'Special LDS Warranty' included with Closing Submittal:
         1) This must be given to Manufacturer:
            (a) Name of Owner (name of FM Group).
            (b) Mailing Address (FM office address).
            (c) Building Property ID (unique 7 digit identifier).
            (d) Project site address.
            (e) Model Number of each Unit.
            (f) Serial Number of each Unit.
            (g) Date of Installation / Startup.

D. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:

1) Final, executed copy of Manufacturer's 'Special LDS Warranty' including required Owner / Manufacturer mandatory information.

b. Record Documentation:

1) Manufacturers' Documentation:

(a) Equipment checkout sheet: Complete and sign all items for each unit.

E. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

F. Shop Drawings: Indicate assembly, required clearances, location and size of field connections.

G. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

H. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

J. Project Record Documents: Record actual locations of components and connections.

## 1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. ASHRAE Compliance:
   a. Applicable requirements in with ANSI/ASHRAE 62.1, Section 5 - 'Systems and Equipment'
2. ASHRAE/ESNA Compliance:
   a. Applicable requirements in ANSI/ASHRAE/IESNA 90.1, Section 6 - 'Heating, Ventilating, and Air-Conditioning'.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

## 1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide fifteen (15) year minimum limited warranty of heat exchanger.

C. Provide five year manufacturers warranty for heat exchangers.

D. Provide five (5) year limited warranty on parts.

# PART 2 PRODUCTS

## 2.01 MANUFACTURERS

A. Manufacturer Contact List:

1. Carrier Corporation:
   a. Carrier National: Robert Lambert, 317-739-9379 , robert.lambert@carrier.com ,
   b. Carrier Utah: Bret Adams (Contractors HVAC Supply); (801) 224-1020 ext. 2527; bret.adams@chcsut.com.
2. Lennox Industries:
   a. For pricing and information contact: Lennox National Account at 1-800-367-6285.
   b. Lennox National Contact: Jeff.barrett@lennoxind.com 801-556-6114
3. York International [US Airconditioning]
   a. Nick Filimoehala n.filimoehala@us-ac.com 801-463-5323

## 2.02 REGULATORY REQUIREMENTS

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

## 2.03 GAS FIRED FURNACES

A. Design Criteria:

1. Rated at 92 percent minimum AFUE (Annual Fuel Utilization Efficiency) calculated in accordance with DOE test procedures.
2. Annual Fuel Utilization Efficiency (AFUE): 0.95 ("condensing") in accordance with ASHRAE Std 103.

B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, humidifier, and accessories; wired for single power connection with control transformer.
1. Safety certified by CSA in accordance with ANSI Z21.47.
2. Venting System: Direct.
3. Combustion: Sealed.
4. Air Flow Configuration: Downflow.
5. Heating: Natural gas fired.
6. Accessories:
    a. Air Piping [venting]
    b. Condensate drain.
    c. Filter Frame
    d. Vibration Isolators

C. Performance: Shown on drawings

D. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner. If not certified for combustible flooring, please provide additional steel base.

E. Primary Heat Exchanger:
1. Material: Hot-rolled steel.
2. Shape: Tubular type.

F. Secondary Heat Exchanger:
1. Material: Aluminized steel.
2. Shape: Tubular type.

G. Gas Burner:
1. Atmospheric type with adjustable combustion air supply.
2. Gas valve, two-stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, and automatic electric valve.
3. Electronic pilot ignition, with electric spark igniter.
4. Combustion air damper with synchronous spring return damper motor.
5. Non-corrosive combustion air blower with permanently lubricated motor.

H. Gas Burner Safety Controls:
1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
2. Flame rollout switch: Installed on burner box and prevents operation.
3. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, and automatic resets.

I. Supply Fan: Centrifugal type rubber mounted with direct drive with adjustable variable pitch motor pulley.

J. Motor:
1. 1750 rpm single-speed, permanently lubricated, hinge mounted.

K. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.

L. Operating Controls:
1. Room Thermostat: Cycles burner to maintain room temperature setting.

2. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation. Provide continuous low-speed fan operation.

M. Approved Products.
1. Standard Furnaces
   a. Carrier: 59SC5A.
   b. Lennox: ML195.
   c. York: TM9E.
2. Two-Stage Heat with ECM motor:
   a. Carrier: 59TN6.
   b. Lennox: EL296V.
   c. York: TM9V.

**2.04 ACCESSORIES**

A. Air Piping [venting]
1. Air Piping: Schedule 40 pipe and fittings meeting requirements of ASTM D1785, ASTM D2661, or ASTM D2665. Only solid core allowed.
2. Installation For Condensing Furnaces:
   a. Run individual vent and individual combustion intake piping from each furnace to concentric roof termination kit provided by Furnace Manufacturer. Slope lines downward toward furnace.
   b. Slope combustion chamber drain downward to funnel drain. Anchor to wall with wall clamps, allowing free movement through clamp for expansion.
   c. Use concentric roof termination kit provided by Furnace Manufacturer. Install vent and combustion air intake piping at clearance and distances required by Furnace Manufacturer.
   d. Attach factory-supplied neoprene coupling to combustion-air inlet connection and secure with clamp.
   e. Ensure that factory-supplied perforated metal disc is installed in flexible coupling, unless its removal is required.
   f. York Furnaces: Install air piping on side of furnace in horizontal or vertical installation.
3. Installation For Condensing Water Heaters:
   a. Run individual vent and individual combustion intake piping from each water heater to roof termination as recommended by Water Heater Manufacturer. Concentric roof termination kit may be used if approved by and provided by Water Heater Manufacturer. Slope lines downward toward water heater.
   b. Slope combustion chamber exhaust drain downward to floor drain.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and located correctly.

C. Verify that proper fuel supply is available for connection.

**3.02 INSTALLATION**

A. Install in accordance with manufacturer's instructions and requirements of authorities having jurisdiction.

B. Install in accordance with NFPA 90A.

C. Install gas-fired furnaces in accordance with NFPA 54.

D. Provide vent connections in accordance with NFPA 211.

E. Pipe condensate to condensate receiver

F. Vibration Isolators:
   1. Install vibration isolator on each hanger rod supporting horizontal furnace and under each corner of vertical furnace.

## 3.03 FIELD QUALITY CONTROL

A. Manufacturer Services:
   1. Furnace installer shall:
      a. Verify proper gas orifice size.
      b. Clock gas meter for rated input.
      c. Verify and set gas pressure at furnace.
      d. Check and measure temperature rise.
      e. Check safety controls for proper operation.
      f. Check combustion vent sizes and combustion air sizes.
   2. In addition, furnace installer shall start up, check out, and adjust furnaces using equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet and include copy in O and M binder/ electronic copy.

**END OF SECTION 23 5400**

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## SECTION 23 6313
## AIR COOLED REFRIGERANT CONDENSERS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Manufactured units.

B. Casing.

C. Condenser coils.

D. Fan requirements.

E. Compressors

F. Controls.

### 1.02 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install compressor units as described in contract documents.
2. Furnish and install compressor units and roof mounted compressor unit curbs as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Equipment bases.

B. Section 23 0923.01 Direct-Digital Control System for HVAC

C. Section 23 2300 - Refrigerant Piping.

D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

### 1.04 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.

C. ASHRAE Std 20 - Methods of Laboratory Testing Remote Mechanical-Draft Air-Cooled Refrigerant Condensers 2019.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

F. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical requirements, and wiring diagrams.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loading, required clearances, and location and size of field connections. Include schematic layouts showing condenser, refrigeration compressors, cooling coils, refrigerant piping and accessories required for complete system.

D. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

E. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer. Provide copy in O&M manual.

### 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

B. Protect units on site from physical damage. Protect coils.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS:

A. Manufacturer Contact List:
   1. Air-Rite Manufacturing; www.air-ritemfg.com.
      a. Blair Halverson; (801) 295-2529.
   2. Carrier Corporation:
      a. Carrier National: Rob Lambert; (317) 739-9379. robert.lambert@carrier.com
      b. Carrier Utah: Bret Adams (Contractors HVAC Supply); (801) 224-1020 ext. 2527; bret.adams@chcsut.com.
   3. Lennox Industries:
      a. For pricing and information call Lennox National Account at (800) 367-6285.
      b. Lennox National Contact: Jeff Barrett Jeff.barrett@lennoxind.com 801-556-6114
   4. Trane, a brand of Ingersoll Rand; www.trane.com/#sle Contact: Jason Bradford, jason.bradford@trane.com, 801-415-2046
   5. York International [US Airconditioning]:
      a. Nick Filimoehala n.filimoehala@us-ac.com 801-463-5323

### 2.02 PERFORMANCE REQUIREMENTS

A. Capacities: SEER rating as defined by AHRI shall be 13.0 or greater and meet code requirements.

B. Follow drawing schedule requirements

### 2.03 MANUFACTURED UNITS

A. Compressor units (5 tons or less)

B. Performance:
   1. Air Conditioners Capacities: SEER2 rating as defined by AHRI shall be 13.4 or greater.

C. Provide packaged, factory assembled, pre-wired unit, suitable for outdoor use consisting of casing, condensing coil and fans, integral sub-cooling coil liquid accumulator.

D. Provide stamped louver coil guard for unit.

E. Construction and Ratings: In accordance with AHRI 210/240 and UL 207. Testing shall be in accordance with ASHRAE Std 20.

F. Performance Ratings: Energy Efficient Rating (EER)/Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1 I-P, in combination with compressor units.

G. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 700. Currently use R-32 or R-454b Refrigerant.

H. Each condenser unit shall have only one compressor.

I. Design with the following features:

1. Externally mounted brass service valves with charging connections.
2. Crankcase heater.
3. Resilient rubber mounts.
4. Compressor motor-overload protection.
5. Single speed.

J. Air Conditioners.
1. Approved Products
a. North Region:
1) Carrier: 26SCA4.
2) Lennox: ML13KC1.
3) York: YC3.
b. Southeast Region:
1) Carrier: 26SCA5.
2) Lennox: ML14KC1.
3) York: YC4.
c. Southwest Region:
1) Carrier: 26TPA8.
2) Lennox: ML17KC2.
3) York: YC6.

**2.04 CASING**

A. House components in welded steel frame with steel panels with weather-resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

C. Provide removable access doors or panels with quick fasteners.

**2.05 CONDENSER COILS**

A. Coils: Aluminum fins mechanically bonded to seamless tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

B. Configuration: Single refrigeration circuit with receiver.

C. Only one liquid line, one suction line, and one power connection shall be made to each compressor. Provide charging valves.

**2.06 FAN REQUIREMENTS**

A. Direct driven propeller type.

B. Fan motor shall be single or two speed, thermostatically controlled, permanently lubricated, and designed with permanent protection.

C. Motors shall be resiliently mounted.

D. Each fan shall have a safety guard.

E. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge, equipped with roller or ball bearings with grease fittings extended to outside of casing.

F. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or with permanent lubricated ball bearings and built-in current and thermal overload protection; refer to Section 23 0513.

G. Compressors
1. Each condenser unit shall have only one compressor.
2. Design with following features:
a. Externally mounted brass service valves with charging connections.
b. Crankcase heater.

c. Resilient rubber mounts.
d. Compressor motor-overload protection.

## 2.07 CONTROLS

A. Provide factory wired and mounted control panel, NEMA 250, containing fan motor starters, fan cycling thermostats, compressor interlock, and control transformer.

B. Provide controls to permit operation down to 0 degrees F ambient temperature.

C. Provide thermostat to cycle fan motors in response to outdoor ambient temperature.

D. Provide head pressure switch to cycle fan motors in response to refrigerant condensing pressure. Head pressure type low ambient kit.

E. Provide Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.

F. Factory wired and located in separate enclosure.

G. Following three paragraphs may not be factory installed and will therefore have to be field installed.
   1. Safety devices:
   2. High and low-pressure cutout.
   3. Condenser fan motor-overload devices.
   4. Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
   5. Head pressure type low ambient kit.

## 2.08 ACCESSORIES

A. Vibration Isolators:
   1. 4 inches (100 mm) square by 3/4 inch (19 mm) thick minimum neoprene type vibration isolation pads.

B. Provide sight glass in liquid line as within 12 inches of coil. Refer to Section 23 2300.

C. Provide filter dryer. Refer to Section 23 2300.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service. See Section 26 0583.

C. Align condensers on concrete foundations. See Section 03 3000

D. Install sight glass in liquid line as within 12 inches of coil. Refer to Section 23 2300.

E. Install filter dryer. Refer to Section 23 2300.

F. Provide connection to refrigeration piping system. See Section 23 2300. Comply with ASHRAE Std 15.

G. General:
   1. Coordinate with other trades affected by the Work of this section.

H. Compressor Units:
   1. Set compressor units level on 'compressor unit curb' on vibration isolation pads located at each corner of unit.
   2. Compressor unit to be anchored solidly to concrete slab.

I. Do not use capillary tube and piston type refrigerant metering devices

J. Air Conditioners:
   1. Provide cooling season start-up, winter season shut-down service, for first year of operation.

2. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

**3.02 FIELD QUALITY CONTROL**

A. Manufacturer Services:
   1. Compressor units shall be started up, checked out, and adjusted by compressor unit Installer.
   2. Use equipment checkout sheet provided by Manufacturer:
      a. Complete and sign all items on sheet. Include copy in O&M Manual.

**END OF SECTION**

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**SECTION 23 7223**
**PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

### 1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install air-to-air Energy Recovery Ventilation (Energy Recovery Ventilator) units as described in Contract Documents.

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.

C. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.

D. Manufacturer's Qualification Statement.

E. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.

### 1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. ASHRAE Compliance:
      a. Applicable requirements in ANSI/ASHRAE 62.1, Section 5 - 'Systems and Equipment'.
      b. Capacity ratings for air-to-air energy recovery equipment shall comply with ANSI/ASHRAE 84, 'Method of Testing Air-to-Air Heat Exchangers'.

B. Manufacturer Qualifications:
   1. Firm regularly engaged in manufacturing energy recovery units.
   2. Products in satisfactory use in similar service for not less than five years.
   3. Manufactured and assembled in the United States of America.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Store in manufacturer's unopened packaging.

B. Store products to be installed indoors in dry, heated area.

### 1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Warranty ventilator to be free from defects in material and workmanship and of all parts for period of 1-1/2 years from date of Substantial Completion.

C. Warranty energy recovery wheel to be free from defects in material and workmanship for 3 years under circumstances of normal use.

D. Warranty motor to be free from defects in material and workmanship for 7 years under circumstances of normal use.

E. Warranty desiccant core to be free from defects in material and workmanship for 5 years under circumstances of normal use.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Energy Recovery Ventilators:
   1. Greenheck Fan Corporation: www.greenheck.com/#sle.
   2. RenewAire: www.renewaire.com/#sle.
   3. S&P USA Ventilation System: www.solerpalau-usa.com/#sle.

## 2.02 ENERGY RECOVERY UNITS

A. Basis of Design Product:
   1. Basis of design for this Project is Energy Recovery Ventilation by RenewAire (model number(s) as shown on Contract Drawings).
   2. Approved Equivalent Product:
      a. Energy Recovery Module Model ECV by Greenheck.
      b. Total Recovery Model TRC by S&P USA Ventilation System.

B. Performance:
   1. Capacities:
      a. Element rated by Manufacturer using method described in ANSI/ASHRAE 84. Exceed 70 percent temperature efficiency.
      b. Applicable for range of ventilation up to 1100 CFM in each air stream without disposition of dust in elements.

C. Construction:
   1. Fixed plate element.
   2. 20 ga (0.95 mm) galvanized steel case with lapped corners.
   3. Leveling legs.
   4. Access door to blowers, energy transfer elements, and filters.
      a. Gasketed to provide air tight seal.
      b. Insulated with 1/4 inch (6.4 mm) Rubatex.
      c. Attached to unit using stainless steel fasteners.

D. Square Duct Openings: Four each 12 inch (305 mm) by 12 inch (305 mm) square duct collars suitable for connection to duct work.

E. Round Duct Openings: Four each 12 inch (305 mm) round duct collars suitable for connection to duct work.

F. Blowers:
   1. Forward curved blades directionally driven by open, drip-proof PSC motor rated for continuous duty.
   2. Motor: 2-3/4 horse power, 115 VAC, single phase, 60 hertz.
   3. Baked enamel finish.

G. 24 VAC control voltage.

## 2.03 SOURCE QUALITY CONTROL

A. Tests:
   1. Provide evidence of independent testing of core by Underwriters Laboratory (UL), verifying maximum flame spread index (FSI) of 25 and maximum smoke development index (SDI) of 50. Meet NFPA 90A and NFPA 90B requirements.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

## 3.02 INSTALLATION

A. Provide openings for suitable ductwork connection.

B. Install per manufacturers instructions.

C. Basis of Design Product - RenewAIre
   1. Suspend Energy Recovery Units from structure

D. Approved Equivalent Product (Greenheck and S&P USA Ventilation System):
   1. Suspend Energy Recovery Units from structure.

2. Coordinate with other Trades to ensure scheduled performance with Contract Drawings and specified performance is met and any installation changes required but not limited to following:
    a. Structural supports for units.
    b. Ductwork sizes and connection locations.
    c. Service clearances.
    d. Interference with existing or planned ductwork, piping, conduit, or wiring.
    e. Electric power requirements and wire-conduit and over-current protection sizes.
    f. Low voltage controls as shown on Contract Drawings.

E. Installer responsible for any additional costs incurred by other affected Trades and Consulting Engineer for work of this section.

**3.03 SYSTEM STARTUP**

A. Provide services of manufacturer's authorized representative to provide start up of unit.

**3.04 CLEANING**

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

**END OF SECTION**

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**SECTION 23 8216**
**AIR COILS**

## PART 1 GENERAL

### 1.01 RELATED REQUIREMENTS

A. Section 22 0719 - Plumbing Piping Insulation.

B. Section 23 0719 - HVAC Piping Insulation.

C. Section 23 2300 - Refrigerant Piping.

D. Section 23 3100 - HVAC Ducts and Casings: Installation of duct coils.

### 1.02 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addenda (2011).

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

### 1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.

B. Protect coils from entry of dirt and debris with pipe caps or plugs.

### 1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for evaporator coil assembly including tubing, fins, drain pan, and factory-installed metering device.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Carrier Corporation:
   1. Carrier National: Bradley Brunner (270) 282-1241 Bradley.M.Brunner@Carrier.utc.com.
   2. Carrier Utah: Bret Adams (Contractors HVAC Supply) (801) 224-1020 ext. 2527 bret.adams@chcsut.com

B. Lennox Industries
   1. For pricing and information contact: Lennox National Account at 1-800-367-6285.
   2. Lennox National Contact: Jeff Barrett, Jeff.barrett@lennox.com, 801-556-6114

C. York International
   1. Nick Filimoehala n.filimoehala@us-ac.com 801-463-5323

### 2.02 REFRIGERANT COILS

A. Manufactured Units
   1. DX Coils:
      a. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish to match air handler.
         1) Coil shall have aluminum fins bonded to seamless copper tubing.
         2) Comply with ANSI/AHRI Standard 210/240. Provide drain pans with connections at one end.
         3) Use thermal expansion valve with brazed joints In place of capillary tube metering device. Compression fittings not acceptable.
   2. Approved Products:
      a. Horizontal:
         1) Carrier: CVAMA.
         2) Lennox: CK40HT.
         3) York: CTM.
      b. Vertical:

1) Carrier: CVAMA.
2) Lennox: CK40CT.
3) York: CTF.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Install in ducts and casings in accordance with SMACNA (DCS).
   1. Support coil sections independent of piping on steel channel or double angle frames and secure to casings.
   2. Arrange supports to avoid piercing drain pans.
   3. Provide airtight seal between coil and duct or casing.
   4. Refer to Section 23 3100.

C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

D. Refrigerant Coils: Provide sight glass in liquid line within 12 inches of coil. Refer to Section 23 2300.

E. Insulate headers located outside air flow as specified for piping. Refer to Section 22 0719.

**END OF SECTION**

**SECTION 23 8516**
**DEHUMIDIFIERS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install ventilating dehumidification units and drain pan as described in Contract Documents.

B. Related Sections:
   1. Section 23 0501: Common HVAC Requirements.
   2. Section 23 0933: Electric And Electronic Control System for HVAC for room humidity sensor.

### 1.02 RELATED REQUIREMENTS

A. Sections 09 9113 - Exterior Painting: Painting of mechanical items requiring field painting.

B. Section 22 0548: Vibration And Seismic Control for HVAC Piping and Equipment.

C. Division 26: 'Electrical' for raceway and conduit, unless specified otherwise, and line voltage wiring.

D. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

### 1.03 DEFINITIONS

A. Compressor: Pump that increases vapor (refrigerant or air) pressure from one level to a higher level of pressure.

B. Dehumidifier: Device that removes humidity, or moisture, from the air.

C. DX (Direct Expansion): Use of refrigerant directly expanded into evaporation coils in supply air stream of an air conditioning unit.

D. Evaporator Coil: Part of an air conditioner located indoors. Evaporator coil cools and dehumidifies the air by converting liquid refrigerant into a gas, which absorbs the heat from the air. The warmest refrigerant is then carried through a tube to the outdoor unit (condenser coil).

E. Humidity: Dampness in the air caused by water vapor.

F. MERV (Minimum Efficiency Reporting Value): Comparison of the efficiency of an air filter/air cleaner. MERV scale ranges from 1 (least efficient) to 16 (most efficient), and measures a filter's ability remove particles from 3 to 10 microns in size. See ANSI/ASHRAE Std 52.2.
   1. 65 percent or MERV 11: Typically applied in standard commercial buildings, such as office space.

G. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.

H. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

### 1.04 REFERENCE STANDARDS

A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.

B. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants 2019.

C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).

D. ASHRAE Std 90.1 I-P-2016 - Energy Standard for Buildings Except Low-Rise Residential Buildings 2016, with Errata (2019).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.

G. FM (AG) - FM Approval Guide current edition.

H. ITS (DIR) - Directory of Listed Products Current Edition.

I. NEMA MG 1 - Motors and Generators 2021.

J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL (DIR) - Online Certifications Directory Current Edition.

## 1.05 ASSOCIATION PUBLICATIONS

A. Federal Emergency Management Agency (FEMA) / Vibration Isolation and Seismic Control Manufacturers Association (VISCMA) / American Society of Civil Engineers (ASCE):
   1. FEMA 412, Installing Seismic Restraints For Mechanical Equipment; December 2002.

B. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
   1. VISCMA 101-12, Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems.
   2. VISCMA 102-12, Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems.

## 1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of [____] with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

D. Scheduling: [____].

## 1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.
         1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
         2) Include name, address, and phone number of each supplier.
      b. Closeout Submittals:
         1) Include following in Operations And Maintenance Manual specified in Section 01 7800:
            (a) Warranty Documentation:
               (1) Compressor: Final, executed copy of Warranty.

## 1.08 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Dehumidifier:
      a. Each unit shall be UL / ULC or ETL labeled.
      b. Energy Star Rated.
      c. Underwriters Laboratories / Underwriters Laboratories of Canada:

1) Comply with requirements of UL 1995.
2. Refrigerants:
a. Underwriters Laboratories:
1) Comply with requirements of UL 2182.
3. Energy Efficiency: Equal to or greater than prescribed by ANSI/ASHRAE/IESNA 90.1.

**1.09 WARRANTY**

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty:
1. Condenser shall have five (5)-year warranty.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A. Dehumidifier:
1. Honeywell International; www.customer.honeywell.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Supports:
1. Unistrut, Part of Atkore International, Inc; www.unistrut.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

C. Vibration Isolators:
1. Kinetics Noise Control Inc; www.kineticsnolse.com.
2. Mason Industries; www.mason-ind.com.
3. Vibration Mountings & Controls; www.vmc-kdc.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 MANUFACTURED UNITS**

A. Approved Products: See Section 01 6200.
1. Dehumidifier:
a. Honeywell TrueDry DR65A2000.
b. Honeywell TrueDry DR90A2000.
c. Honeywell TrueDry DR120A2000.

B. Description:
1. Dehumidifier utilizes refrigeration and internal air circulation to cool incoming air stream below its dew point.

C. Design Criteria:
1. Dehumidifier:
a. General:
1) Fin surface shall be continuous plate type aluminum fins of specific design to produce maximum heat transfer efficiency for heat pipe applications.
2) Heat transfer fluid shall be classified as Safety Group A1 in ASHRAE Standard 34 (R410A).
3) Tubes shall be copper and permanently expanded onto fin collar to form firm, rigid, and complete pressure contact at all operating conditions.
b. Humidity Removal at 80 deg F (26.7 deg C), sixty (60) percent RH:
1) DR65: 65 pints per day (30.76 liter per day).
2) DR90: 90 pints per day (42.59 liter per day).
3) DR120: 120 pints per day (56.78 liter per day).
c. Energy Performance:
1) DR65: 4.7 pints (2.22 liters) per kilowatt hr.
2) DR90: 5.3 pints (2.51 liters) per kilowatt hr.
3) DR120: 5.7 pints (2.70 liters) per kilowatt hr.
d. Air Flow Performance:

1) DR 65: 160 CFM at 0.0 inch WC; 120 CFM at 0.4 inch WC; 100 CFM at 0.6 WC.
2) DR 90: 235 at 0.0 inch WC; 180 CFM at 0.4 inch WC; 175 CFM at 0.6 WC.
3) DR 120: 350 at 0.0 inch WC; 210 CFM at 0.4 inch WC.

e. Electrical Usage:
1) DR65: 5.2 amps.
2) DR90: 6.5 amps.
3) DR120: 7.0 amps.

f. Operating Range: 34 deg F (1.1 deg C) to 135 deg F (57 deg C).

g. Air Filter: Provide MERV 11.

D. Active Dehumidification Equipment:
1. Blower, Fan, And Motor:
a. Centrifugal blower with forward curved blades.
b. Blower to be statically and dynamically balanced.
c. Motor to be high efficiency direct drive, permanent split capacitor (PSC) type with sleeve bearing.
2. Compressor:
a. R410A refrigerant.
3. Controls:
a. Humidity setpoint of sixty five (65) percent RH set through Prestige or T7350 thermostat, using H7635 humidity sensor, with setpoint accessible via W7350 WebStat controller.
b. Low voltage transformer for 24 V control power.
c. 110-120 VAC, 60 Hz.
d. Lock out system to shut unit down if high- or low-pressure condition exists, on compressor overload, or on failure of condensate drain system.
4. Evaporator Coil:
a. Seamless copper tubing with internal microgrooves.
b. Permanently expand tubes into aluminum fins.

**2.03 ACCESSORIES**

A. Drain Pan:
1. 22 ga (0.0336 in) (0.8534 mm) galvanized steel coated with drip pan coating.
2. 3/4 inch (19 mm) female NPT connection.

B. Supports:
1. Acceptable Products:
a. P-1000 channel and M2137 swivel anchor by Unistrut.
b. Equal as approved by Architect before installation. See Section 01 6200.

C. Vibration Isolators:
1. Horizontal Installation:
a. Design Criteria:
1) Equipment requiring isolation shall be isolated as per recommended goals of ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms'.
2) Provide vibration isolators, base frames and inertia bases of sufficient size and design to assure that deflection and stability requirements are met. Isolators shall be provided to deflect uniformly under operating loads.
3) Unless otherwise indicated, all equipment mounted on vibration isolated bases shall have minimum operating clearance of 2 inch (50 mm) between the base and floor or support beneath.
4) Steel components shall be cleaned of welding slag and coated with approved primer.
5) Neoprene hanger type with load of 75 lbs (34 kg) maximum.

b. Approved Products. See Section 01 6200:
    1) Model RH by Kinetics.
    2) Model HD by Mason.
    3) Model RH by Vibration Mountings.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Locate dehumidifier near furnace return ducts for ease of connection.

B. Hang units from structure as per detail on Contract Drawings.

C. Drain Pan:
    1. Provide drain pan below units, and pipe drain and secondary drain to condensate receiver.
    2. Equipment shall be placed within drain pan, secure and level.
    3. Install Vibration Isolator on each hanger rod supporting horizontal dehumidifiers as per Manufacturer's instructions.
    4. Double nut all threaded rod hanger connections to lock in position.
    5. Provide logical access to service air filter.

**END OF SECTION**

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**SECTION 23 8241**
**ELECTRIC UNIT HEATERS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Wall heaters.

### 1.02 INCLUDES BUT NOT LIMITED TO

A. Furnish and install electric unit heaters as described in Contract Documents.

### 1.03 RELATED REQUIREMENTS

A. 23 0923 Direct-Digital Control System for HVAC

### 1.04 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addenda (2011).

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
   3. Indicate mechanical and electrical service locations and requirements.

D. Certificates: Certify that air coil capacities, pressure drops, and selection procedures meet or exceed specified requirements or coils are tested and rated in accordance with AHRI 410.

E. Manufacturer's Instructions: Indicate installation instructions and recommendations.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

### 1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Unit heaters shall be UL listed and comply with NEC requirements.

## PART 2 PRODUCTS

### 2.01 WALL HEATERS [TYPICAL IN FIRE RISER ROOM]

A. Manufacturers:
   1. Berko, Marley Electric Co, Bennettsville. SC www.berkomeh.com.
   2. QMark, Marley Electric Co, Bennettsville, SC www.qmarkmeh.com.
   3. Raywall, Johnson, TN www.raywall.com.

B. Surface mounting.

C. Sheet metal casing.

D. Heating element shall be encased in steel finned casting and protected by thermal switch.

E. Fan motor shall be permanently lubricated and dust protected bearings.

F. Fan shall be vibration free.

G. Units shall be controlled automatically by external thermostat provided as specified in Section 23 0923 Direct-Digital Control System for HVAC.

H. UL listed.

I. Open coil element or enclosed in steel casing.

J. Thermal cutout with indicator light and one time thermal fuse.

K. Finish: Baked-on enamel.

L. Design Standard. Q Mark QFG22281F (2.2KW) controller used with these plans can only handle 12.5 amps.

M. Surface mounting, include backbox (Catalog number GFRBB).

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

### 3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Do not damage equipment or finishes.

D. Cabinet Unit Heaters:
   1. Install as indicated.
   2. Coordinate to ensure correct recess size for recessed units.

### 3.03 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

### 3.04 PROTECTION

A. Provide finished cabinet units with protective covers during the balance of construction.

**END OF SECTION**

**SECTION 26 0500**
**COMMON WORK RESULTS FOR ELECTRICAL**

## PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

A. Section 01 3216 - Construction Progress Schedule: Scheduling of equipment and materials removed by Owner.

B. Section 01 4000 - Quality Requirements

C. Section 02 4100 - Demolition: Salvage of existing electrical items to be reused or recycled.

D. Section 07 8400 - Firestopping: Quality of Penetration Firestop Systems to be used on Project and submittal requirements.

### 1.02 REFERENCES

A. National Fire Protection Association / American National Standards Institute: NFPA 70 National Electric Code (NEC).

B. National Electrical Manufacturing Association Standards (NEMA): NEMA 250, 'Enclosure for Electrical Equipment (1000 Volts Maximum)'.

### 1.03 SUMMARY

A. Section Includes:
   1. Electrical equipment coordination and installation.
   2. Firestopping.

### 1.04 SUBMITTALS

A. Refer to individual material specification sections for submittal requirements.

### 1.05 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls,and other structural components as they are constructed.

C. Coordinate installation of required supporting devices and set sleeves under site elements and paving components as they are constructed.

### 1.06 QUALIFICATIONS

A. Requirements of Section 01 4000 - Quality Requirements applies, but not limited to following:
   1. Electrical Subcontractor:
      a. Company specializing in performing work of this project.
      b. Minimum five (5) years experience in electrical installations.
      c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
      d. Upon request, submit documentation.
   2. Installer:
      a. Licensed in state where work is to be performed.
      b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project. Foreman shall have at least a journeyman's electrician license.
      c. Upon request, submit documentation.
      d. Approved Installers:

1) Approved Electrical Subcontractor shall be pre-approved in accordance with Supplementary Conditions and included in Construction Documents by Addendum.

## PART 2 PRODUCTS

### 2.01 DESIGN CRITERIA

A. Equipment provided under following Sections shall be by the same Manufacturer:
   1. Section 26 2416 - Panelboards
   2. Section 26 2816.13 - Enclosed Circuit Breakers
   3. Section 26 2816.16 - Enclosed Switches

### 2.02 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   2. Pressure Plates: Carbon steel. Include two for each sealing element.
   3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

B. Manufacturers:
   1. OZ-Gedney type WSK.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verification Of Conditions:
   1. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.

### 3.02 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Comply with applicable provisions of Occupational Safety and Health Act (OSHA), NFPA Standards and Pamphlets, NEIS Standards, and common work place practice.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Locations of electrical equipment shown on Drawings are approximate only. Field verify actual locations for proper installation.

F. Coordinate electrical equipment locations and conduit runs with those providing equipment to be served before installation or rough in.
   1. Notify Architect of conflicts before beginning work.
   2. Coordinate locations of power and lighting outlets in mechanical rooms and other areas with mechanical equipment, piping, ductwork, cabinets, etc, so they will be readily accessible and functional.

G. Work related to other trades which is required under this Division, such as cutting and patching, trenching, and backfilling, shall be performed according to standards specified in applicable Sections.

### 3.03 FIELD QUALITY CONTROL

A. Test systems and demonstrate equipment as working and operating properly. Notify Architect before test. Rectify defects at no additional cost to Owner.

B. Measure current for each phase of each motor under actual final load operation, i.e. after air balance is completed for fan units, etc. Record this information along with full-load nameplate current rating and size of thermal overload unit installed for each motor.

C. Refer to individual equipment and material specification sections for additional testing requirements.

**3.04 CLEANING**

A. Remove abandoned raceways, conductors, apparatus, and lighting fixtures promptly from site and dispose of legally.

**3.05 CLOSEOUT ACTIVITIES**

A. Training:
   1. Provide instructor to train Owner's maintenance personnel in operation and maintenance of electrical equipment and systems. Factory representatives shall assist this instruction as necessary.
   2. Schedule instruction period at time of final inspection.
   3. Refer to individual material and equipment specification sections for additional training requirements.

**3.06 FIRESTOPPING**

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section 07 8400 - Firestopping.

**END OF SECTION**

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## SECTION 26 0519
## LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Nonmetallic-sheathed cable.

C. Underground feeder and branch-circuit cable.

D. Armored cable.

E. Metal-clad cable.

F. Wiring connectors.

G. Electrical tape.

H. Heat shrink tubing.

I. Oxide inhibiting compound.

J. Wire pulling lubricant.

K. Cable ties.

### 1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 23 0923 - Direct-Digital Control System for HVAC: Conductors and cables for temperature control system.

C. Section 26 0500 - Common Work Results for Electrical

D. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

### 1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   1. Article 334, ''Non-metallic-Sheathed Cable, Types NM, NMC And NMS'.

J. UL 4 - Armored Cable Current Edition, Including All Revisions.

K. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.

L. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.

M. UL 267 - Outline of Investigation for Wire-Pulling Compounds Most Recent Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.

P. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.

Q. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables Current Edition, Including All Revisions.

R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.

S. UL 719 - Nonmetallic-Sheathed Cables Current Edition, Including All Revisions.

T. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

## 1.04 DEFINITIONS

A. Line Voltage: Over 70 Volts.

## 1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

## 1.06 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

## 1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

## 1.09 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

## PART 2 PRODUCTS

### 2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. For branch circuit wiring in dry locations within structures permitted to be of Types III, IV, and V construction, where fully sprinklered.
   2. In addition to other applicable restrictions, may not be used:
      a. Where exposed to view.
      b. Where exposed to damage.
      c. Where not concealed with sheet rock on both sides.
      d. For damp, wet, or corrosive locations.
      e. Where in contact with earth.
      f. Above suspended ceilings.
      g. Where in contact with concrete.
      h. Where restricted by NFPA 70 Article 334.

D. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where run above accessible ceilings for final connections from junction boxes to luminaires.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
   2. In addition to other applicable restrictions, may not be used:
      a. Where not approved for use by the authority having jurisdiction.
      b. Where exposed to view except on equipment platform or catwalk.
      c. Where exposed to damage.
      d. Where in contact with earth.
      e. Where in contact with concrete.
      f. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

### 2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless

specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.

a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
   1) Services: Copper conductors size #6 and larger.
   2) Feeders: Copper conductors size #6 and larger.
b. Where aluminum conductors are substituted for copper, comply with the following:
   1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
   2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.

3. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
4. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      2) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
   a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
   a. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   b. Equipment Ground, All Systems: Green.

## 2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
   a. Cerro Wire LLC: www.cerrowire.com/#sle.
   b. Encore Wire Corporation: www.encorewire.com/#sle.
   c. General Cable Technologies Corporation: www.generalcable.com/#sle.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
   a. Size 10 AWG and Smaller: Solid.
   b. Size 8 AWG and Larger: Stranded.
   c. Wiring inside of walk-in cooler and freezer shall be stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN-2 or XHHW-2, except as indicated below.
   a. Conductors in walk-in cooler and freezer: Type XHHW only.

## 2.04 NONMETALLIC-SHEATHED CABLE

A. Manufacturers:
   1. Encore Wire Corporation: www.encorewire.com/#sle.
   2. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

## 2.05 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

B. Provide equipment grounding conductor unless otherwise indicated.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

## 2.06 ARMORED CABLE

A. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN.

E. Grounding: Combination of interlocking armor and integral bonding wire.

F. Armor: Steel, interlocked tape.

## 2.07 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

G. Armor: Steel, interlocked tape.

H. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

## 2.08 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use re-usable compression connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use compression connectors.
   3. Connections Outside Building: Watertight steel spring wire connections with waterproof, non-hardening sealant.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
   5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
   7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. NSI Industries LLC: www.nsiindustries.com/#sle.

G. Push-in Wire Connectors: Rated 600 V, 221 degrees F.
   1. Manufacturers:
      a. Ideal Industries, Inc: www.idealindustries.com/#sle.
      b. NSI Industries LLC: www.nsiindustries.com/#sle.

H. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Thomas & Betts Corporation: www.tnb.com/#sle.

K. Power Distribution Block: Terminals suitable for use with 75°F (24°C) copper conductors.
   1. 16323 by Cooper Bussmann, Ellisville, MO www.bussmann.com
   2. LBA363106 by Square D Co, Palatine, IL www.us.squared.com.
   3. Substitutions: See Section 01 6000 - Product Requirements

## 2.09 ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
   2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
   3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
   5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
   6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
   7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Burndy LLC: www.burndy.com/#sle.

C. Wire Pulling Lubricant:
   1. Listed and labeled as complying with UL 267.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Suitable for use at installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

F. Verify that raceway system is complete, and cabinets and outlet boxes are free of foreign matter and moisture.

## 3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

## 3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Install circuits as shown in Panel Schedules. Group circuit homeruns to panels as shown on Contract Drawings.
4. Arrange circuiting to minimize splices. Conductors and cables shall be continuous from outlet to outlet.
5. Include circuit lengths required to install connected devices within 10 ft of location indicated.
6. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
7. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
8. Install wiring of different voltage systems in separate conduits.
9. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
    a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    b. Increase size of conductors as required to account for ampacity derating.
    c. Size raceways, boxes, etc. to accommodate conductors.
10. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install nonmetallic-sheathed cable (Type NM-B) in accordance with NECA 121.

E. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

F. Install metal-clad cable (Type MC) in accordance with NECA 120.

G. Pre-wired 3/8-inch flexible fixture whips: Allowed only for connection to recessed lighting fixtures, lengths not to exceed 72 inches.

H. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

I. Exposed Cable Installation (only where specifically permitted):
1. Route cables parallel or perpendicular to building structural members and surfaces.
2. Protect cables from physical damage.

J. Line Voltage Cable Installation:
1. Where installing in framing, do not bore holes in joists or beams outside center 1/3 of member depth or within 24 inches (600 mm) of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width. Holes shall be one inch diameter maximum.
2. Conceal cables within ceilings and walls of finished areas. Cables may be exposed in unfinished areas but not run on floors of mechanical equipment spaces or in such a way that they obstruct access to, operation of, or servicing of equipment.
3. Install exposed cables parallel to or at right angles to building structure lines.
4. Keep cables 6 inches (150 mm) minimum from hot water pipes.
5. Do not support cables from mechanical ducts or duct supports without Architect’s written approval.

6. Do not bore holes in vertical truss members or notch structural members for cable installation.

K. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

L. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

M. Terminate cables using suitable fittings.
   1. Armored Cable (Type AC):
      a. Use listed fittings and anti-short, insulating bushings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
   2. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

N. Install conductors with a minimum of 12 inches of slack at each outlet.

O. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

P. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

Q. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

R. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
      b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

3. Wet Locations: Use heat shrink tubing.

S. Insulate ends of spare conductors using vinyl insulating electrical tape.

T. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

U. Identify conductors and cables in accordance with Section 26 0553.

V. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

W. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

**3.04 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

**END OF SECTION**

**SECTION 26 0523**
**CONTROL-VOLTAGE ELECTRICAL CABLES**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install control-voltage electrical cables as described in Contract Documents.

### 1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 23 0913 - Instrumentation and Control Devices for HVAC.

C. Section 23 0923 - Direct-Digital Control System for HVAC: Conductors and cables for temperature control system.

D. Section 26 0500 - Common Work Results for Electrical.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 0918 - Remote Control Switching Devices.

G. Section 26 0923 - Lighting Control Devices.

H. Section 27 1000 - Structured Cabling.

I. Section 27 4118 - Video Systems.

J. Section 27 4117 - Audio Systems.

K. Section 28 3111 - Building Intrusion Detection.

L. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

### 1.03 DEFINITIONS

A. Control Voltage: 70 Volts and under.

## PART 2 PRODUCTS

### 2.01 SYTEM

A. Manufacturers:
   1. Approved Cable Manufacturers. See Section:
      a. Alpha Wire Co, Elizabeth, NJ www.alphawire.com.
      b. Belden Wire & Cable Co, Richmond, IN www.belden.com.
      c. Liberty Wire & Cable, Colorado Springs, CO www.libertycable.com.
      d. West Penn Wire Corp, Washington, PA www.westpenn-cdt.com.

B. Components:
   1. Building Control System Cables.
      a. CAT 5E, 24 AWG, solid bare copper, four pair, UTP, white cable jacket.
      b. Sheath Colors:
         1) Lighting Control: Yellow.
      c. Meet requirements of EIA / TIA 568 Standard.
   2. Lighting Control Cables and Conductors:
      a. Provide cable per Lighting Control Panel Manufacturer’s recommendations and requirements.
      b. Lighting Control Cables ran in same raceway as line voltage cables shall have same insulation voltage rating as line voltage conductors.
      c. Cable Jacket shall be yellow.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. General:
   1. Cables shall be continuous and without splices from source to outlet.
   2. Conceal cables within ceilings and walls of finished areas. Cables may be exposed in unfinished areas but not run on floors of mechanical equipment spaces or in such a way that they obstruct access to, operation of, or servicing of equipment unless otherwise indicated in Contract Drawings.
   3. Run cables in raceway as indicated on Contract Drawings.
   4. Run exposed cables parallel to or at right angles to building structure lines.
   5. Keep cables 6 inch (150 mm) minimum from hot water pipes.
   6. Support cables using approved staples, cable ties, straps, hangers, or similar fittings spaced every 3 feet (900 mm).
   7. Where installing in framing, do not bore holes in joists or beams outside center 1/3 of member depth or within 24 inches (600 mm) of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width. Holes shall be 1/2 inch (13 mm) diameter maximum.
   8. Bundle only cables of same systems together.
   9. Install cables in raceway. Run cables of different systems in separate conduits.
   10. Do not run cables within 10 inches (255 mm) of line voltage conductors/raceways.
   11. Extend cables 18 inches (450 mm) from wall or ceiling at all outlet locations. Extend cables to twice vertical length of cabinet at each cabinet location.
   12. Pulling cables into conduit:
      a. Do not pull cables until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
      b. Do not use heavy mechanical means for pulling cables.
      c. Use only listed wire pulling lubricants.
   13. Prohibited procedures:
      a. Boring holes for installation of cables in vertical truss members.
      b. Notching of structural members for installation of cables.

B. Control Cables:
   1. For cables not installed in raceway, do not run cables within 10 inches (255 mm) of line voltage conductors / raceways. Also, maintain 10 inches (255 mm) minimum between following exposed cable groups:
      a. Microphone cables.
      b. CAT-6, sound system control, telephone, video, or ATC cables.
      c. Loudspeaker cables.

**END OF SECTION**

## SECTION 26 0526
## GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground access wells.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete

B. Section 26 0500 - Common Work Results for Electrical

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

D. Section 26 0536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 4300 - Surge Protective Devices.

### 1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 780 - Standard for the Installation of Lightning Protection Systems 2023.

G. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Pre-Installation Conference:
      a. Participate in pre-installation conference as specified in Section 03 3111.
      b. Review Architect's inspection of grounding conductor installation before placement of concrete.
   2. Do not install ground rod electrodes until final backfill and compaction is complete.

3. Notify Architect for inspection two (2) days minimum before placing concrete over grounding conductor.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

## 1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

# PART 2 PRODUCTS

## 2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

E. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet

at an accessible location not more than 5 feet from the point of entrance to the building.
b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Ring:
   a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
6. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.
7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
8. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
   c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    b. Metal gas piping.
8. Equipment bonding for Baptismal Fonts
    a. Copper Lug Mechanical Connector:
        1) Provide copper connectors to bond to metallic element fastener
        2) Acceptable Products:
            (a) Pentair EL4 by Erico International, Solon, OH www.erico.com
            (b) Equal as approved by Architect before bidding. See Section 01 6000 - Product Requirements.
    b. Grounding Clamps and Connectors:
        1) Provide heavy duty rebar clamps to bond to structural reinforcing bars.
        2) Acceptable Products:
            (a) RC70 by Eritech International, Glendale, CA www.eritech.com.
            (b) Equal as approved by Architect before bidding. See Section 01 6000 - Product Requirements.

H. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
    c. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
    d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

I. Lightning Protection Systems:
1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.
2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.

## 2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
    a. Exceptions:
        1) Use bare copper conductors where installed underground in direct contact with earth.
        2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
4. Manufacturers - Mechanical and Compression Connectors:
    a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
    b. Burndy LLC: www.burndy.com/#sle.
    c. Thomas & Betts Corporation: www.tnb.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:
    a. Burndy LLC: www.burndy.com/#sle.
    b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.
    c. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

F. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
    a. Rectangular Wells: Not less than 12 by 12 inches.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide grounding bushings on all feeder conduit entrances into panelboards and equipment enclosures.

D. Provide separate insulated grounding conductor from each equipment cabinet to electrical panel. Do not use intermediate connections or splices. Affix directly to cabinet.

E. Connect ground conductors to conduit with approved grounding bushing and to metal motor frame with bolted solderless lug.

F. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

G. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

H. Identify grounding and bonding system components in accordance with Section 26 0553.

I. Connect all metallic elements of baptismal font as shown in Contract Drawings. Connect grounding clamps and connector to structural reinforcing bars as per NFPA 70 Article 680 and as shown in Contract Drawings.

**3.03 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

**END OF SECTION**

## SECTION 26 0529
## HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

E. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

### 1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

D. MFMA-4 - Metal Framing Standards Publication 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 3000.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

## 1.06 QUALITY ASSURANCE

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

# PART 2 PRODUCTS

## 2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of [_____]. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

D. Metal Channel/Strut Framing Systems:
   1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   2. Comply with MFMA-4.
   3. Channel Material:
      a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   4. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
   5. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Trapeze Support for Multiple Conduits: 3/8-inch diameter.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   4. Hollow Masonry: Use toggle bolts.

5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 26 0533.13 for additional requirements.

I. Box Support and Attachment: See Section 26 0533.16 for additional requirements.

J. Interior Luminaire Support and Attachment: See Section 26 5100 for additional requirements.

K. Exterior Luminaire Support and Attachment: See Section 26 5600 for additional requirements.

L. Secure fasteners in accordance with manufacturer's recommended torque settings.

M. Remove temporary supports.

### 3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

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**SECTION 26 0533.13**
**CONDUIT FOR ELECTRICAL SYSTEMS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Stainless steel rigid metal conduit (RMC).
B. Galvanized steel rigid metal conduit (RMC).
C. Galvanized steel intermediate metal conduit (IMC).
D. Stainless steel intermediate metal conduit (IMC).
E. Flexible metal conduit (FMC).
F. Liquidtight flexible metal conduit (LFMC).
G. Galvanized steel electrical metallic tubing (EMT).
H. Stainless steel electrical metallic tubing (EMT).
I. Rigid polyvinyl chloride (PVC) conduit.
J. Electrical nonmetallic tubing (ENT).
K. Liquidtight flexible nonmetallic conduit (LFNC).

### 1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 26 0500 - Common Work Results for Electrical: Sleeve seals for conduit penetrations.
C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
    1. Includes additional requirements for fittings for grounding and bonding.
D. Section 26 0529 - Hangers and Supports for Electrical Systems.
E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
F. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
G. Section 31 2316 - Excavation and Trenching.
H. Section 31 2323 - Fill and Aggregate Base: Bedding and backfilling.

### 1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.
I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
K. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT) 2014 (Reaffirmed 2019).

L. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series 2015.

M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.

O. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

P. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel Current Edition, Including All Revisions.

Q. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.

R. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

S. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.

T. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel Current Edition, Including All Revisions.

U. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

V. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

W. UL 1653 - Electrical Nonmetallic Tubing Current Edition, Including All Revisions.

X. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.

Y. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

## 1.06 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), or rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or schedule 80 rigid PVC conduit where emerging from underground.
   5. Where steel conduit is installed in direct contact with earth, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
   6. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Not permitted.
   2. Within Slab Above Ground: Not permitted.

E. Concealed Within Masonry Walls: Use intermediate metal conduit (IMC).

F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT) or Electrical non-metallic tubing (ENT).

G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT) or Electrical non-metallic tubing (ENT).

H. Interior, Damp or Wet Locations: Use intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit or liquid tight flexible non-metallic conduit (LFNC).
   1. Maximum Length: 6 feet.

N. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 3 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

O. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

P. Wiring inside of walk-in coolers and freezers: Use liquidtight flexible metal conduit.

## 2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.

C. Fittings for Grounding and Bonding: See Section 26 0526 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. For exterior use: 3/4 inch (21 mm)
   2. For interior use: 1/2 inch (16 mm)

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## 2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   3. Material: Use steel or malleable iron.

## 2.04 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
   2. Material: Use stainless steel with corrosion resistance equivalent to conduit.

3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

## 2.05 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular.com/#sle.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

## 2.06 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.

## 2.07 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.

## 2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

## 2.09 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com.
   2. Nucor Tubular Products: www.nucortubular/#sle.
   3. Wheatland Tube Company: www.wheatland.com.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel.
      a. Do not use die cast zinc fittings.
   4. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.
   5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

## 2.10 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Connectors and Couplings: Use compression/gland or set-screw type.
   3. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

## 2.11 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com/#sle.
   2. JM Eagle: www.jmeagle.com/#sle.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## 2.12 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com/#sle.

B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.

C. Fittings:
   1. Manufacturer: Same as manufacturer of ENT to be connected.
   2. Use solvent-welded type fittings.

3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

## 2.13 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
   1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. IPEX, a division of Aliaxis: www.ipexna.com/#sle.

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

## 2.14 PROHIBITED FITTING MATERIALS

A. The following fitting type are not permitted: crimp-on, tap-on, indenter, and cast set-screw fittings for EMT.

B. Spray (aerosol) PVC cement.

## 2.15 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
   1. Spray (aerosol) PVC cement is not permitted.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

F. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

G. Expansion Fittings: Designed to allow for expansion and contraction in a run of conduit, suitable for type of conduit installed.
   1. Products:
      a. Hot Dip Galvanized: O-Z/Gedney (Emerson) type AX.
      b. PVC: Carlon type E945.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Notify Architect in writing if substrates are not acceptable to install raceways and boxes.
   1. Commencing installation constitutes acceptance of existing conditions.

## 3.02 INSTALLATION

A. Furnish and install air-vapor barrier boxes, electric service raceways, telephone service raceways, and internet service raceways as described in the contract documents.
   1. Install raceways for building services in accordance with service providers requirements.

B. Install Owner provided corner A/V equipment cabinets.
C. Install products in accordance with manufacturer's instructions.
D. Install conduit in accordance with NECA 1.
E. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
F. Install intermediate metal conduit (IMC) in accordance with NECA 101.
G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
H. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.
I. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
J. Conduit Routing:
    1. Unless dimensioned, conduit routing indicated is diagrammatic.
    2. When conduit destination is indicated without specific routing, determine exact routing required.
    3. Conceal conduits unless specifically indicated to be exposed.
    4. Conduits in the following areas may be exposed, unless otherwise indicated:
        a. Electrical rooms.
        b. Mechanical equipment rooms.
        c. Within joists in areas with no ceiling.
    5. Unless otherwise approved, do not route exposed conduits:
        a. Across floors.
        b. Across roofs.
        c. Across top of parapet walls.
        d. Across building exterior surfaces.
    6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
    7. Arrange conduit to maintain adequate headroom, clearances, and access.
    8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
    9. Arrange conduit to provide no more than 150 feet between pull points.
    10. Route conduits above water and drain piping where possible.
    11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
    12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
    13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
        a. Heaters.
        b. Hot water piping.
        c. Flues.
    14. Group parallel conduits in same area on common rack.
K. Conduit Support:
    1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 0529.
    2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
    3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
    4. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
    5. Use conduit clamp to support single conduit from beam clamp or threaded rod.

6. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
7. Use of wire for support of conduits is not permitted.
8. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

L. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.
9. Provide PVC adapters at all boxes.

M. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 8400.

N. Installation in concrete:
1. Install no conduit in concrete unless outside diameter is less than 1/3 of slab, wall, or beam thickness in which it is embedded.
2. Position conduits in center of concrete below reinforcing steel, and separated by minimum lateral spacing of three diameters.
3. Elbows embedded in concrete shall be rigid steel or IMC and stubouts from concrete slabs shall extend 3 inches (75 mm) minimum before making connection to EMT.
4. Separate conduits penetrating structural slabs in buildings by 2 inches (50 mm) minimum.
5. Install seal device where underground raceways penetrate concrete building wall.

O. Underground Installation:
1. Provide trenching and backfilling; see Section 31 2316 and Section 31 2323.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 18 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
      1) Install conduits under slab on grade only at locations shown on the drawings.

3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 0553.
4. Where in contact with earth or concrete, wrap buried galvanized rigid steel and galvanized IMC conduit and fittings completely with corrosion protection tape.

P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

Q. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

R. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

S. Provide grounding and bonding; see Section 26 0526.

T. Identify conduits; see Section 26 0553.

## 3.03 PROHIBITED PROCEDURES

A. Installation of raceway beneath or embedded in concrete, except where explicitly shown on Contract Documents.

B. Use of wooden plugs inserted in concrete or masonry units for mounting raceway, supports, boxes, cabinets, or other equipment.

C. Installation of raceway that has been crushed or deformed.

D. Use of torches for bending PVC.

E. Spray applied PVC cement.

F. Boring holes in truss members.

G. Notching of structural members.

H. Supporting raceway from ceiling system support wires.

I. Nail drive straps or tie wire for supporting raceway.

## 3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

## 3.05 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

## 3.06 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**END OF SECTION**

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## SECTION 26 0533.16
## BOXES FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

### 1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 26 0533.23 - Surface Raceways for Electrical Systems:

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

### 1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate with Divisions 22 and 23 for installation of raceway for control of plumbing and HVAC equipment.
3. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
5. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
6. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
7. Coordinate the work with other trades to preserve insulation integrity.
8. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
9. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures and floor boxes.

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, and installation of product.

D. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

## 1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

D. Firms regularly engaged in manufacturing of boxes for electrical systems of type and size required, whose products have been in satisfactory use in similar service for not less than ten (10) years.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

# PART 2 PRODUCTS

## 2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
   12. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.: 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
      b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
   13. Wall Plates: Comply with Section 26 2726.
   14. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
      c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
      d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      e. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Vapor-Tight Boxes:
   1. Premolded polyethylene box installed in all exterior framing walls (thermal envelope) around recessed outlet boxes.
   2. Approved Manufacturers:
      a. Lessco Low energy Systems Supply Company, Inc. Campbellsport, WI www.lessco-airtight.com

D. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
      a. Indoor Clean, Dry Locations: Type 1, painted steel.
      b. Outdoor Locations: Type 3R, painted steel.
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide hinged-cover enclosures unless otherwise indicated.
      b. Boxes 6 square feet and Larger: Provide hinged-cover enclosures.
   4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
      a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
      b. Back Panels: Painted steel, removable.

5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
    c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

E. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Provide vapor-tight boxes where indicated in the contract documents.
1. Carefully cut above grade vapor barrier and seal around recessed outlet boxes to minimize air infiltration.

I. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
    a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.

b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

J. Box Mounting Heights:
1. HVAC:
    a. Temperature Control Junction Boxes: As indicated on Drawings.
    b. Thermostats not mounted in occupied space: As indicated on Drawings.
    c. Remote Temperature Sensors and thermostats mounted in occupied space:
        1) Wall-Mounted: 50 inches to top.
        2) Column-Mounted: As indicated on Drawings.
2. Plumbing:
    a. Electric Water Cooler Outlets: Mount so outlet and cord are hidden by water cooler and outlet is accessible for resetting for GFCI trip.
3. Electrical:
    a. Receptacles: 18 inches.
    b. Wall Switches: 42 inches.
    c. Wall-Mounted Exit Lights: 90 inches.
    d. Emergency Lighting Units: 60 inches.
    e. Sound Distribution System Components: As indicated on Drawings.
    f. Satellite Distribution System Components: As indicated on Drawings.
    g. TV Distribution System Components: As indicated on Drawings.
    h. Computer and TV: 18 inches.
    i. Telephones (wall type): 60 inches.
    j. Telephones (desk type): 18 inches.
    k. Telephone / Data (desk type): 18 inches.
    l. Data (desk type): 18 inches.
    m. Signal Chimes: 84 inches.
    n. Refer to other sections for mounting heights of electrical equipment not listed above.

K. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

L. Install boxes plumb and level.

M. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.

2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

N. Install boxes as required to preserve insulation integrity.

O. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
1. Furnish and install inset material to match the floor finish.

P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

R. Close unused box openings.

S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

T. Provide grounding and bonding in accordance with Section 26 0526.

U. Identify boxes in accordance with Section 26 0553.

**3.03 CLEANING**

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

**3.04 PROTECTION**

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**END OF SECTION**

## SECTION 26 0553
## IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

### 1.02 RELATED REQUIREMENTS

A. Section 26 0536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.

B. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.

C. Section 26 2300 - Low-Voltage Switchgear: Factory-installed mimic bus.

D. Section 26 2416 - Panelboards.

### 1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace 2021.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

### 1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

### 1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

### PART 2 PRODUCTS

### 2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Enclosed switches:
   1) Provide identification nameplate to indicate power source and circuit number. Include location when not within sight of equipment.
   2) Provide identification nameplate to identify load(s) served. Include location when not within sight of equipment.

c. Time Switches:
   1) Identify load(s) served and associated circuits controlled. Include location.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
   b. Use identification nameplate to identify load served by each breaker. Do not identify spares or space.
3. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
4. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
   a. Service equipment.
   b. Motor control centers.
   c. Elevator control panels.
   d. Panelboards.
   e. Switchboards
5. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazardsfor panelboards.
   a. Minimum Size: 3.5 by 5 inches.
   b. Service Equipment: Include the following information in accordance with NFPA 70 and NFPA 70E.
      1) Nominal system voltage.
      2) Arc flash boundary.
      3) Available incident energy.
      4) Working distance.
      5) Minimum arc rating of clothing.
      6) Required PPE.
      7) Date label applied.

B. Identification for Devices:
   1. Grouped dimmer switches: Provide nameplate for each dimmer identifying load controlled.

## 2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; 1/4 inch engraved text.
   2. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.

2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conductors and Cables: Legible from the point of access.
8. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Mark all handwritten text, where permitted, to be neat and legible.

**END OF SECTION**

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**SECTION 26 0583**
**WIRING CONNECTIONS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Electrical connections to equipment.

### 1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0533.13 - Conduit for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2726 - Wiring Devices.

### 1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

### 1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

### 2.02 EQUIPMENT CONNECTIONS

A. Electric ranges:
   1. Electrical Connection: Cord (4-wire, grounding) and plug (NEMA 14-50P). 48 inch minimum cord length.

## PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

## 3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

**END OF SECTION**

**SECTION 26 0918**
**REMOTE CONTROL SWITCHING DEVICES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Networked switching controls.

B. Programmable switching controls.

C. Remote control switching relays.

D. Remote switches.

E. Remote sensors.

F. Power supplies.

G. Relay cabinets.

### 1.02 RELATED REQUIREMENTS

A. Section 250500 - Common work Results for integrated automation

B. Section 26 0500 - Common Work Results for Electrical.

C. Section 26 0523 - Control-Voltage Electrical Cables.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0533.16 - Boxes for Electrical Systems: Switch outlets and installation of switch devices.

F. Section 26 0923 - Lighting Control Devices.

### 1.03 DEFINITIONS

A. Class A: Equipment has been tested and found to comply with limits for Class A digital device, pursuant to part 15 of FCC Rules. These limits provide reasonable protection against harmful interference when equipment is operated in commercial environment.

### 1.04 REFERENCE STANDARDS

A. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2015

B. IEC 62443 -4-2 Technical Security Requirements for IACS components

C. 47 CFR 15 - Radio Frequency Devices; current edition.
   1. Emission requirements for Class A applications.

D. NEMA ICS 4 - Application Guideline for Terminal Blocks; 2015.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data showing dimensions and ratings for components.

C. Shop Drawings: Indicate wiring diagrams of system, showing interface with branch circuit wiring.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Information Submittals:
   1. Certifications:
      a. Technician Certification that equipment has been installed, adjusted and tested in accordance with Manufacturer's recommendations.

F. Project Record Documents: Record actual locations of components and record circuiting and switching arrangements.

G. Maintenance Data: Include replacement parts numbers.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Cabinet Keys: Two of each different key.

**1.06 QUALITY ASSURANCE**

A. Comply with requirements of NFPA 70.

B. Regulatory Agency Sustainability Approvals:
   1. All control equipment shall be in compliance with FCC emissions' standards in Part 15 Subpart J for Class A application.
   2. Programmable panelboards shall be UL listed under UL 916 Energy Management Equipment.

C. Qualifications:
   1. Manufacturer Qualifications:
      a. Manufacturer of assembly shall be manufacturer of major components with assembly.
      b. Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
   2. Technician Qualifications:
      a. Authorized by Manufacturer and trained.
      b. Have thorough knowledge of software, hardware and system programming.

D. Certifications:
   1. Provide Technician Certification that equipment has been installed, adjusted and tested in accordance with Manufacturer's recommendations.

E. Products: Listed, classified, and labeled as suitable for the purpose intended.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

**1.07 DELIVERY, STORAGE AND HANDLING**

A. Delivery And Acceptance Requirements:
   1. Equipment shall be delivered, handled and stored in accordance with manufacturer's instructions.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS:**

A. Acceptable Manufacturer:
   1. Leviton Manufacturing Co, Little Neck, NY www.leviton.com or Leviton Manufacturing of Canada Ltd, Pointe-Claire, QB (800) 461-2002 or (514) 954-1840
   2. Lutron Electronics Co Inc, Coopersburg, PA www.lutron.com.
   3. Watt Stopper Inc., Santa Clara, CA www.wattstopper.com.
   4. Coopper controls- www. https://www.cooperlighting.com/global/controls-wiring/building-systems#WAVELINX%20SYSTEMS
   5. GE-Daintree, www.gecurrent.com
   6. Substitutions: See Section 01 6000 - Product Requirements

B. Design Criteria:
   1. Lighting Control System shall meet or exceed following capabilities:
      a. Capable of switching for specific lighting zone for following:
         1) Time-of-day scheduling
         2) Daylight savings time adjustments
         3) Light level sensors

4) Room occupancy
5) 10% to 100% continuous dimming using a 0-10 V protocol
6) Provide support for open protocol Zigbee and Z-wave devices.
7) Communication to a building management system using an open BacNET IP or BacNET MS/TP protocol.
8) Provide on-site web server interface.

2. Unacceptable lighting control systems:
   a. Systems that use cloud based web server interfaces with or without monthly recurring charges are not acceptable.
   b. Systems locked to an exclusive installer in the geogrefical area are not acceptable

**2.02 NETWORKED LIGHTING CONTROL**

A. Description: Distributed switching control using networking programmable relay panels, with central computer and mobile application for operator interface, programming control sequences, and monitoring.

B. Central Computer: Furnished by Owner.

C. Software Features:
1. Security: Password protection for accessing and modifying data.
2. Data Protection: Full data backup capability.
3. Operating Schedules: Capacity of 12 for each programmable relay panel and 12 system wide time schedules. System-wide schedules adjust relay panel schedules globally.
4. Programming: Available from central computer and downloaded to individual programmable relay panels.
5. Diagnostics: Include diagnostic and testing procedures to enable troubleshooting.
6. Maintenance Data: Track runtime in minutes and relay operation in cycles.
7. Warning Flicker: Flash lights 5 minutes before shutting down.
8. Time Delay: Allow adjustable time delay between scheduled ON-OFF and operation of individual relay.
9. Egress and Common Area Links: Operate identified relays ON when other circuits in common area are energized; allow adjustable time delay after other circuits de-energize before operating identified relays OFF.

D. Networking Hardware and Software: Support BacNet protocol (IP or MS/TP) communications. Coordinate with BMS installer so that all device funtions are methods are available to the BMS system controller. All control points shall be labeled in the system per the device and location of the device.

**2.03 PROGRAMMABLE RELAY PANELS**

A. Description: Relay cabinet with power supply, terminal blocks, and logic cards for the specified programming functions.

B. Relays per Panel: As indicated.

C. Programming Functions:
1. Multiple Switch Control: More than 1 switch can control each relay.
2. Pilot Status Indication: Signal for indicating relay status at remote location.
3. Relay Grouping: Allow relays to be grouped for common control.
4. Scheduling:
   a. Allow scheduling of 99 events each capable of switching 1 relay groups according to a programmed time schedule.
   b. Allow for up to 12 holidays.
   c. Provide menu driven control for seven 7 day repeating schedules.
   d. Clock shall provide user selectable pre-programmed scenarios for: Scheduled on/off, Manual on/off, Scheduled off, and on/off when used with photocell control module.
5. Network Control: Allow remote control using IP communications.

D. Programmable Digital Control Switches:

1. Programmable digital control switches shall be provided with number of control buttons as indicated on Contract Drawings.
    a. Each button shall be capable of individual programming without use of computer or other programming device.
    b. Each button shall be able to control individual relay or group of relays.
    c. Individual buttons shall allow for permanent labeling.
2. Switches shall be illuminated for ease of location in dark.

E. Cabinet: Flush-mounted sheet metal cabinet.

**2.04 REMOTE CONTROL SWITCHING RELAYS**

A. Description: Heavy duty, two-coil momentary contact type remote control relays.

B. Relays: Panel shall utilize solid state relays rated for 20A load at 120/277VAC with 10,000A short circuit current rating and shall include contactor for exterior lighting control.

C. Line Voltage Connections: Clamp type screw terminals.

**2.05 REMOTE SWITCHES**

A. Wall Switch: Toggle type.
1. Description: Momentary contact, three position switches, white color, rated 3 amperes at 25 VAC.

B. Switches with Pilot Lamp:

**2.06 REMOTE SENSORS**

A. Exterior Lighting Sensor:
1. Description: Photodiode lighting sensor in weatherproof Class 2 housing.
    a. Provide photodiode compatible with the lighting control system

B. Interior Lighting Sensor:
1. Description: Photodiode lighting sensor suitable for mounting on wall or ceiling and characterized with a dead band to eliminate ON-OFF cycling of relays in response to its own switching action.
2. Light sensor shall be provided for day-light control, capable of controlling continuously dimmed loads.
3. System components include, but are not limited to, following items:
    a. 20 to 2000 foot candle photocell with necessary mounting hardware.
    b. Control relays or contactors and transformers for up to six circuits.
    c. Sensor controller with HIGH, LOW, and DEAD BAND adjustments.
    d. Except for photocell, install components in single, locking enclosure.
4. Products:
    a. Provide products compatible with the lighting control system

**2.07 LIGHTING CONTACTOR:**

A. 120V coil, 20 amps, 2 pole, NEMA 1 enclosure.

B. By same manufacturer as main panelboard.

C. Products:
1. Cutler Hammer: CN35.
2. General Electric: CR260L-21CA22.
3. Siemens: LEN01B200120A.
4. Square D: Class 8903, Type LG-20.

**2.08 RELAY CABINETS**

A. Boxes: Galvanized steel with removable endwalls.

B. Interior Panel: Metal, suitable for mounting components, matte white. NEMA 1 enclosure unless noted otherwise on drawings.

C. Fronts: Steel, flush type with concealed trim clamps door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

D. Metal Barriers: Between wiring of different systems and voltages.

E. Assembly: Panel shall be factory assembled and designed for disassembly for mounting enclosure first and reassembly after conduit installation.

F. Power Terminals: NEMA ICS 4, unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

G. Signal and Control Terminals: NEMA ICS 4, modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

H. Ground Bus Terminal Block: Bond each connector to enclosure.

I. Plastic Raceway:
   1. Description: Plastic channel with hinged or snap-on cover.

J. Power Supply: NFPA 70, Class 2 transformer, interior assembly with motherboard and control electronics.
   1. Ratings: 120 /24 volt, 75 VA momentary, 40 VA continuous.
   2. Rectifier: Silicon, rated 20 amperes intermittent, 7.5 amperes continuous, 30 VAC, 100 PRV.

## 2.09 POWER LIMITED WIRE AND CABLE

A. Remote Control Cable: Copper conductor, 300 volt insulation rated 60 degrees C, individual conductors twisted together and covered with PVC jacket.

B. Plenum Cable: Copper conductor, 300 volt insulation rated 60 degrees C, individual conductors twisted together and covered with nonmetallic jacket; suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

C. Cable jacket color: Yellow.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Install wiring in conduit in accordance with Section 26 0533.13.

B. General:
   1. Install switches flush with wall, straight and level.
   2. Permanently label switches as shown on drawing schedule in Contract Drawings.

C. Interface With Other Work:
   1. Coordinate with appropriate Sections of Divisions 26.
   2. Program system to meet the local energy code.
   3. Coordinate with the building managment system (BMS) installer. Program schedules at the BMS main control station.

D. Space Control Requirements:
   1. Unless relevant provisions of applicable local Energy codes are more stringent, provide minimum application of lighting controls as follows:
      a. Provide occupancy/vacancy sensors with Manual-ON/OFF functionality in all.
      b. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room or classroom. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling-mounted sensors and Manual-ON switches, if necessary.

E. Install relays to be accessible. Allow space for adequate ventilation and circulation of air.

F. Perform any additional programming required to meet the local energy codes.

## 3.02 FIELD QUALITY CONTROL

A. Field Testing:

1. Manufacturer shall provide Manufacturer's authorized Technician to adequately test supplied equipment and software to ensure system performs as intended including the following:
    a. Test start-up system and confirm proper installation, operation, and adjustment of all system components.
    b. Submit Certification in writing that equipment has been installed, adjusted and tested in accordance with Manufacturer's recommendations.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
    1. Correct any work found defective or not complying with Contract Document requirements at no additional cost to the Owner.

**3.03 CLOSEOUT ACTIVITIES**

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
    1. Operations and Maintenance Manual;
        a. Equipment operation and maintenance manual(s).

B. Instruction of Owner:
    1. Provide Manufacturer's authorized Technician training session for Owner's Representative(s) for demonstrating operation and programming of completed system.
        a. Training program shall include instructions on control system, programming, and other major components. Provide Manufacturer Manual(s) to be submitted to Owner to assist training.
        b. Training program shall include:
            1) System review of all system components and their function.
            2) System review of all man3agement software and its function.
            3) Operator training to develop experience with control applications.

**END OF SECTION 26 0918**

**SECTION 26 0923**
**LIGHTING CONTROL DEVICES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Outdoor motion sensors.

C. Time switches.

D. Outdoor photo controls.

E. Daylighting controls.

### 1.02 RELATED REQUIREMENTS

A. Section 26 0500 - Common Work Results for Electrical

B. Section 26 0523 - Control-Voltage Electrical Cables

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems

E. Section 26 0533.16 - Boxes for Electrical Systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 0918 - Remote Control Switching Devices: Remotely controlled devices for lighting control, including networked lighting controls, programmable relay panels, and remote control switching relays.

H. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

I. Section 26 5100 - Interior Lighting.

J. Section 26 5600 - Exterior Lighting.

### 1.03 DEFINITIONS

A. Class A: Equipment has been tested and found to comply with limits for Class A digital device, pursuant to part 15 of FCC Rules. These limits provide reasonable protection against harmful interference when equipment is operated in commercial environment.

### 1.04 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2017.

C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.

H. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

I. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

L. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

M. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

N. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

O. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

P. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

Q. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

R. Federal Communications Commission (FCC):
   1. Emission requirements for Class A applications.

## 1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

## 1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Informational Submittals:
   1. Certifications:
      a. Technician Certification that equipment has been installed, adjusted and tested in accordance with Manufacturer’s recommendations.

G. Operation and Maintenance Data: Include detailed information on device programming and setup.

H. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Equipment operation and maintenance manual(s).

I. Project Record Documents: Record actual installed locations and settings for lighting control devices.

## 1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Regulatory Agency Sustainability Approvals:
   1. All control equipment shall be in compliance with FCC emissions' standards in Part 15 Subpart J for Class A application.
   2. Programmable panelboards shall be UL listed under UL 916 Energy Management Equipment.

C. Qualifications:
   1. Manufacturer Qualifications:
      a. Manufacturer of assembly shall be manufacturer of major components with assembly.
      b. Manufacturer of this equipment shall have minimum of five (5) years manufacturing experience.
   2. Technician Qualifications:
      a. Authorized by Manufacturer and trained.
      b. Have thorough knowledge of software, hardware and system programming.

D. Certifications:
   1. Provide Technician Certification that equipment has been installed, adjusted and tested in accordance with Manufacturer's recommendations.

E. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

G. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.08 DELIVERY, STORAGE, AND PROTECTION

A. Delivery And Acceptance Requirements.
   1. Equipment shall be delivered, handled and stored in accordance with manufacturer's instructions.

## 1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

# PART 2 PRODUCTS

## 2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

## 2.02 OCCUPANCY SENSORS

A. Manufacturers:
   1. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
   2. Sensor Switch Inc; _____: www.sensorswitch.com/#sle.
   3. WattStopper; _____: www.wattstopper.com/#sle.
   4. Coopper controls; www. https://www.cooperlighting.com
   5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
    a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
    b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
    c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on with occupant manual operation and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
9. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.

C. Wall Switch Occupancy Sensors:
1. All Wall Switch Dimming Occupancy Sensors:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
    c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    e. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
2. Products:
    a. Cooper: OSW-D-010-W
    b. Leviton: ODD10-IDW
    c. Watt Stopper: DW-311
    d. Lutron: MS-Z101-W

D. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
    a. Description: Low profile occupancy sensors designed for ceiling installation.
    b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
    c. Finish: White unless otherwise indicated.

d. Provide manual ON and OFF momentary override switches. Refer to Contract Drawings for

2. Products - Ultrasonic:
   a. Cooper:
      1) Sensor: OAC-U-0501-R.
      2) Relay / Transformer: SP20-MV.
   b. IR-TEC America:
      1) Sensor: OS-361DT.
      2) Relay / Transformer: PPU-300.
   c. Leviton:
      1) Sensor: OSC05-RUW.
      2) Relay / Transformer: OPP20-D2.
   d. Sensorswitch:
      1) Sensor: CMPDT9.
      2) Relay / Transformer: MP-20-SP0DM.
   e. Watt Stopper:
      1) Sensor: W-500A.
      2) Relay / Transformer: BZ-150.
3. Products - Passive Infrared (PIR):
   a. Cooper:
      1) Sensor: OAC-P-1500-R.
      2) Relay / Transformer: SP20-MV.
   b. IR-TEC America:
      1) Sensor: OS-361.
      2) Relay / Transformer: PPU-300.
   c. Leviton:
      1) Sensor: OSC15-RIW.
      2) Relay / Transformer: OPP20-D2.
   d. Sensorswitch:
      1) Sensor: CM10.
      2) Relay / Transformer: MP-20-SP0DM.
   e. Watt Stopper:
      1) Sensor: CI-205.
      2) Relay / Transformer: BZ-150.
4. Products - Dual Technology:
   a. Cooper:
      1) Sensor: OAC-DT-0501-R.
      2) Relay / Transformer: SP20-MV.
   b. IR-TEC America:
      1) Sensor: OS-361DT.
      2) Relay / Transformer: PPU-300.
   c. Leviton:
      1) Sensor: OSC05-RMW.
      2) Relay / Transformer: OPP20-D2.
   d. Sensorswitch:
      1) Sensor: CMPDT9.
      2) Relay / Transformer: MP-20-SP0DM.
   e. Watt Stopper:
      1) Sensor: DT-305.
      2) Relay / Transformer: BZ-150.

E. Power Packs for Low Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on drawings.

**2.03 TIME SWITCHES**

A. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Digital Time Switch:
a. 24-hour digital time switch, multiple on and off setting points.
b. Provide minimum 10 hour power outage backup to retain programming and maintain clock.
c. Products (120V).
1) Intermatic: ET1105CPD82.
2) Paragon: EC4004PC/120.
3) Tork: E101PB.
d. Products (277V)
1) Intermatic: T7402BC.
2) Tork: W-222L.
3. Digital Time Switch:
a. 7-Day Time Switches: Single channel, capable of different schedule for each day of the week.
b. Provide minimum 10 hour power outage backup to retain programming and maintain clock.
c. Products.
1) Intermatic: ET1705PD82.
2) Paragon: EC7004/120.
3) Tork: EW101B.
4. Input Supply Voltage: 120 V ac unless otherwise indicated.
5. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
a. Indoor clean, dry locations: Type 1.

B. Electromechanical Time Switches:
1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
2. Program Capability:
a. 24-Hour Time Switches: With same schedule for each day of the week.
b. Products:
1) Intermatic: T101.
2) Paragon: 4001-00.
3) Tork: 1101.
3. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
4. Input Supply Voltage: 120 V ac unless otherwise indicated.
5. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
a. Indoor clean, dry locations: Type 1.

**PART 3 EXECUTION**

## 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

## 3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

## 3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

G. Provide required supports in accordance with Section 26 0529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Time Switches:
   1. Install time switches, manual bypass switches, and contactor inside building. Label each component to identify lighting controlled. See Section 26 0553 - Identification for Electrical Systems for labeling requirements.
   2. Install time switches, manual bypass switches, and contactor inside building to control parking area and building exterior lighting. See Section 26 0553 - Identification for Electrical Systems for labeling requirements.

J. Wire photocell and time switch in series for photo cell ON, time switch OFF operation.

## 3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

## 3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

## 3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Prior to Substantial Completion, meet with personnel designated by Owner to:
   1. Identify location of control system components.
   2. Explain operation of each component.
   3. Demonstrate adjustment capabilities of time clocks, including turning systems OFF at times other than sunrise and keeping systems OFF on days facility is closed.
   4. Set time clocks as directed.

C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   4. Location: At project site.

**END OF SECTION 26 0923**

**SECTION 26 2100**
**LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Electrical service requirements.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.

B. Section 26 0500 - Common Work Results for Electrical.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 2416 - Panelboards: Service entrance equipment.

F. Section 31 2316 - Excavation and Trenching.

G. Section 31 2323 - Fill and Aggregate Base: Bedding and backfilling.

### 1.03 PRICE AND PAYMENT PROCEDURES

A. Allowances:
   1. See Section 01 2100 - Allowances, for allowances affecting this section.
   2. Include cash allowance for complete cost of service including Utility Company charges associated with providing service.

### 1.04 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

### 1.05 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

## PART 2 PRODUCTS

### 2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Division of Responsibility:
   1. Pad-Mounted Utility Transformers:
      a. Transformer Vaults and Pads: Furnished and installed by Contractor per Utility Company requirements.
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.

d. Grounding: Furnished and installed by Contractor per Utility Company requirements.
e. Primary:
    1) Trenching and Backfilling: Provided by Contractor.
    2) Conduits: Furnished and installed by Contractor.
    3) Conductors: Furnished and installed by Utility Company.
f. Secondary:
    1) Trenching and Backfilling: Provided by Contractor.
    2) Conduits: Furnished and installed by Contractor.
    3) Conductors: Furnished and installed by Contractor (Service Point at transformer).

2. Terminations at Service Point: Provided by Utility Company.
3. Metering Provisions:
    a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
    b. Meter: Furnished and installed by Utility Company.
    c. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
    d. Metering Transformers: Furnished and installed by Utility Company.
    e. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
    f. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.

D. Products Furnished by Contractor: Comply with Utility Company requirements for service entrance fittings, meter sockets, and current transformer (CT) cabinets where required..

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

### 3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required trenching and backfilling in accordance with Section 31 2316 and Section 31 2323.

E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03 3000.

F. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.

**END OF SECTION**

**SECTION 26 2416**
**PANELBOARDS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Load centers.

D. Overcurrent protective devices for panelboards.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0500 - Common Work Results for Electrical.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 26 4300 - Surge Protective Devices.

### 1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

D. NEMA PB 1 - Panelboards 2011.

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.

F. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 70E - Standard for Electrical Safety in the Workplace 2021.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

K. UL 67 - Panelboards Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include wiring diagrams showing all factory and field connections.
2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
3. Include documentation of listed series ratings.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.

## 1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

### 1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: Not Permitted.

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

### 2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
   2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   3. Label equipment utilizing series ratings as required by NFPA 70.
   4. Power Distribution Panelboards:
      a. Minimum integrated equipment short circuit rating of 10,000 amperes for 120 / 208 Volts.
      b. Minimum integrated equipment short circuit rating of 50,000 amperes for 277 / 280 Volts.
   5. Lighting and Appliance Panelboards:
      a. Minimum integrated equipment short circuit rating of 10,000 amperes for 120 / 208 Volts.
      b. Minimum integrated equipment short circuit rating of 14,000 amperes for 277 / 280 Volts.
   6. Load Centers:
      a. Minimum integrated equipment short circuit rating of 10,000 Amps.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
   c. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
   a. Use zero sequence ground fault detection method unless otherwise indicated.
   b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

M. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

N. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

## 2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Products:
1. Eaton: PRL4B.
2. ABB/GE: Spectra Series.
3. Siemens: Type P4.
4. Schneider/Square D: I-Line.

C. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

D. Bussing:
   1. Phase and Neutral Bus Material: Aluminum.
   2. Ground Bus Material: Aluminum.

E. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
   2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 175 amperes.
   3. Provide electronic trip circuit breakers for circuit breaker frame sizes 200 amperes and above.

F. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide metal circuit directory holder mounted on inside of door.

## 2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Products:
   1. Eaton: Type PRL1a.
   2. ABB/GE: Type AL or AQ.
   3. Siemens: Type P1.
   4. Schneider/Square D: Type NQOD.

C. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

D. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum.
   3. Ground Bus Material: Aluminum.

E. Circuit Breakers: Thermal magnetic bolt-on.

F. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide metal circuit directory holder mounted on inside of door.
   4. Factory installed or provided circuit number identification for each breaker and space.

## 2.05 LOAD CENTERS

A. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.

B. Products:
   1. Eaton: Type CH.
   2. ABB/GE: PowerMark Plus.

3. Siemens: Type PL.
4. Schneider/Square D: Type QO.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Bus Material: Aluminum or copper.

D. Circuit Breakers: Thermal magnetic HACR plug-in type.

E. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
2. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.

## 2.06 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
2) 14,000 rms symmetrical amperes at 480 VAC.
b. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
3. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 200 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
a. Provide the following field-adjustable trip response settings:
1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
2) Long time delay.
3) Short time pickup and delay.
4) Instantaneous pickup.
5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
8. Do not use tandem circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:
a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator. Include coil-clearing contact to break coil circuit when breaker opens.
b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

## 2.07 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

B. Verify that mounting surfaces are ready to receive panelboards.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify wall framing for proper spacing for installation of panelboard(s). Notify Architect of improper spacing in writing.

E. Contractor shall be responsible for performing required calculations to determine Arc Flash Hazards and providing all appropriate labeling per NFPA 70E.

### 3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

J. Provide minimum of two spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 26 0526.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

N. Set field-adjustable circuit breaker tripping function settings as directed.

O. Set field-adjustable ground fault protection pickup and time delay settings as directed.

P. Provide filler plates to cover unused spaces in panelboards.

Q. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

R. Identify panelboards in accordance with Section 26 0553.

## 3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than [_____] amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

## 3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

## 3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

**SECTION 26 2726**
**WIRING DEVICES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

E. Floor box service fittings.

### 1.02 RELATED REQUIREMENTS

A. Section 11 6623 - Gymnasium Equipment for motorized basketball backstop.

B. Section 26 0500 - Common Work Results for Electrical.

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

D. Section 26 0526 - Grounding and Bonding for Electrical Systems.

E. Section 26 0533.16 - Boxes for Electrical Systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

### 1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.

4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

**1.05 SUBMITTALS**

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Field Quality Control Test Reports.

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, and installation of product.

E. Operation and Maintenance Data:
1. GFCI Receptacles: Include information on status indicators.

**1.06 QUALITY ASSURANCE**

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

**1.07 DELIVERY, STORAGE, AND PROTECTION**

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

**PART 2 PRODUCTS**

**2.01 WIRING DEVICE APPLICATIONS**

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles serving electric drinking fountains.

**2.02 WIRING DEVICE FINISHES**

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices Installed on light colored walls: White with white nylon wall plate.

C. Wiring Devices Installed on dark colored walls: Black with black nylon wall plate.

D. Wiring Devices Installed on black walls: Black with black nylon wall plate.

E. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

F. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover.

**2.03 WALL SWITCHES**

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
   1. Products:
      a. Pass & Seymour (Legrand): PS20AC.
      b. Leviton: 1221-2.
      c. Cooper: AH1221.
      d. Hubbell HBL: 1221.
      e. Substitutions: See Section 01 6000 - Product Requirements.

C. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.
   1. Products:
      a. Cooper: 1895W.
      b. Hubbell: HBL1556W.
      c. Legrand: 1250W.

## 2.04 WALL DIMMERS

A. Wall Dimmers - General Requirements: Provide dimmer switches of the same brand as lighting control system. Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

## 2.05 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 15A, 125V, NEMA 5-15R; single or duplex as indicated on the drawings.
      a. Products - Decora (Rectangular) Style:
         1) Cooper: 6262W.
         2) Hubbell: HBL2152WA.
         3) Leviton: 16252-W.
         4) Pass & Seymour: 26252-W.
      b. Products - Standard Style:
         1) Cooper: TR5262.
         2) Hubbell: BR20.
         3) Leviton: TBR20.
         4) Pass & Seymour: TR20.

C. Range receptacles:

1. Flush mounted, straight blade, 50A, 125/250V, 3-pole 4-wire grounding, NEMA 14-50R, complete with plate.
    a. Products:
        1) Cooper: 1258.
        2) Hubbell: HBL9450A.
        3) Leviton: 279.
        4) Pass & Seymour: 3894.

D. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

E. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
1. All outlets for meetinghouse application shall be tamper resistant

F. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 15A, 125V, NEMA 5-15R, rectangular decorator style.
    a. Products:
        1) Cooper: GF15W.
        2) Hubbell: GF5252WA.
        3) Leviton: 8599-W.
        4) Pass & Seymour: 1594-W.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

G. Locking Receptacles: Industrial specification grade.
1. Motorized Basketball Backstop receptacle:
    a. Flush mounted, locking, 20A, 125/250V, 3-pole 4-wire grounding, NEMA L14-20R, complete with plate.
    b. Products:
        1) Cooper: CWL1420R.
        2) Hubbell: HBL2410.
        3) Leviton: 2410.
        4) Pass & Seymour: L1420-R.
2. Dry Pack Equipment receptacle:
    a. Flush mounted, locking, 20A, 125V, grounding, NEMA L5-20R, complete with plate.
    b. Products:
        1) Hubbell: HBL23105W with HBL2030AP straight wall box adapter.

## 2.06 WALL PLATES

A. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.
   1. Products:
      a. Hubbell: WP26MH, horizontal; WP26M, vertical.
      b. Intermatic: WP1010HMC, horizontal; WP1010MC, vertical.
      c. Red Dot: CKMG, horizontal; CKMGV, vertical.

### 2.07 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
   1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
   2. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.

B. Description: Service fittings compatible with floor boxes provided under Section 26 0533.16 with components, adapters, and trims required for complete installation.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting heights: Refer to section 26 0533.16 - Boxes for Electrical Systems for device mounting heights.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

## 3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

## 3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

## 3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

**END OF SECTION 26 2726**

**SECTION 26 2816.16**
**ENCLOSED SWITCHES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Enclosed safety switches.

### 1.02 RELATED REQUIREMENTS

A. Section 26 0500 - Common Work Results for Electrical.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

F. Section 26 2813 - Fuses.

### 1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.

D. Field Quality Control Test Reports.

E. 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.

F. Project Record Documents: Record actual locations of enclosed switches.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

## 1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

## 1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

# PART 2 PRODUCTS

## 2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

## 2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
   2. Minimum Ratings:
      a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
      b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Provide compression lugs where indicated.
      c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

P. Provide the following features and accessories where indicated or where required to complete installation:
   1. Hubs: As required for environment type; sized to accept conduits to be installed.
   2. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

B. Verify that mounting surfaces are ready to receive enclosed safety switches.

C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 26 0553.

J. Furnace disconnect: Provide single pole wall switch. Refer to Section 26 2726 - Wiring Devices for requirements.
   1. Install furnace disconnects on furnace at location where it is accessible from front of unit and it does not interfere with unit’s operation.

K. Unit Heater disconnect: Provide manual starter with thermal overload relay. Provide overload relay to match motor full load amps. Refer to Section 26 2913 - Enclosed Controllers for requirements.

**3.03 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

**3.04 ADJUSTING**

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

**3.05 CLEANING**

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

## SECTION 26 4113
## LIGHTNING PROTECTION FOR STRUCTURES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Strike (air) terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

#### 1.02 RELATED REQUIREMENTS

A. Section 07 7100 - Roof Specialties: Strike (air) terminal attachment to ridge vents.

B. Section 07 7100 - Roof Specialties: Lightning protection system attached to 'Lightning Rod Cover Plate'.

C. Section 07 9200 - Joint Sealants: Sealing around strike (air) terminal washer.

D. Section 10 7430: ‘Aluminum Steeple’.

E. Section 10 7431: ‘Glass-Fiber-Reinforced Steeple’.

F. Section 26 0526 - Grounding and Bonding for Electrical Systems: Electrical system grounds.

G. Section 26 4300 - Surge Protective Devices.

H. Surge Protection for Wiring Systems: Specified in individual system requirements.

#### 1.03 REFERENCE STANDARDS

A. NFPA 780 - Standard for the Installation of Lightning Protection Systems 2023.

B. UL 96 - Lightning Protection Components Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a meeting at least at least two weeks prior to commencement of any work affected by lightning protection system requirements to discuss prerequisites and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

#### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

1. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.

C. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.

D. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.

E. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

#### 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum three years documented experience.

B. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience.

C. Installer Qualifications: Company specializing in lightning protection system design with minimum three years documented experience.

D. Field Quality Control Testing Agency Qualifications: Firm capable of and experienced in grounding and bonding testing with documented experience and minimum of three project references.

E. Products: Listed, classified, and labeled as suitable for the purpose intended.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Lightning Protection Components:
   1. Advanced Lightning Technology (allG) www.allgfab.com
   2. Robbins Lightning, Inc: www.robbinslightning.com/#sle.
   3. Erico International, Solon, OH www.erico.com.
   4. Independent Protection Company (IPC), Goshen, IN www.ipclp.com.
   5. VFC Inc, Woods Cross, UT www.vfcinc.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

### 2.02 LIGHTNING PROTECTION SYSTEM

A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.
   1. Provide system that protects:
      a. The entire structure.
      b. Open air areas within 100 feet of exterior walls at grade level.
      c. Open air areas within building footprint.
   2. Coordinate with other grounding and bonding systems specified.
   3. Determine ground resistance by field measurement.
   4. Provide copper, bronze, or stainless steel components, except where aluminum is allowed by NFPA 780.

B. Strike Terminals: Provide strike (air) terminals on the following:
   1. Integral to the Steeple.
   2. Ridge Vents when applicable.

### 2.03 COMPONENTS

A. All Components: Complying with applicable requirements of UL 96.

B. Lightning protection equipment provided for Steeple / Tower under this Section:
   1. Cable: Smooth weave copper, minimum 32 strands of 17 gauge: IPC No. 32S.
   2. Ground Clamps: Bronze for 3/4-inch ground rods, copper clad: IPC No. 579.
   3. Ground Plate: Bi-metal bonding plate as supplied by steeple manufacturer.
   4. Pressure Cable Clamp: IPC No. 297A.
   5. Cable Loop Fastener, copper: IPC No. 121A.
   6. Right Angle Through-Roof Connector: IPC No. 597X, bronze, for use with copper cable in steeple / tower.
   7. Inspection / test well: Robbins Lightning, Inc. No. 89C-18.
   8. Ground rod: 10' long x 3/4" diameter copper clad steel: IPC No. 579

C. Lightning protection equipment attached to ridge vent.
   1. Air terminal (blunt tip): 1/2 inch (12.7 mm) x 12 inches (305 mm) long solid aluminum quality standard IPC No. A331 - BT.
   2. Stainless steel nut.
   3. Stainless steel washer and neoprene washer.
   4. Bronze ground clamps for 3/4 inch (19 mm) rod: IPC No. 28U.
   5. Smooth weave copper cable, minimum 32 strands of 17 gauge: IPC No. 32S.

## PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work with installation of steeple, ridge vent, roofing, and exterior and interior finishes .

## 3.02 INSTALLATION

A. Install in accordance with referenced system standards and as required for specified certification.

B. All conductors in contact with flammable materials, such as untreated wood, plastic, etc.. shall be contained in conduit.

C. Connect conductors using mechanical connectors or exothermic welding process; protect adjacent construction elements and finishes from damage.

D. Install Lightning Rod Cover Plate; plate furnished by others.

E. Ground Rods:
   1. Install ground rods 3 feet (900 mm) minimum away from building or any part of building. Drive each rod until top is a minimum of one foot (300 mm) below finish grade.
   2. Connect cable to ground rods with ground clamps.
   3. Over each ground rod, install inspection / test well with cover flush with finish grade.

F. Cable:
   1. Install lightning cable with continuous horizontal or downward course, free from down and up pockets.
   2. Radius of bends shall not be less than 8 inches (200 mm) and never tighter than 90 degree angle.
   3. Install cable supports every 36 inches (900 mm) along run through building using specified cable fasteners.
   4. Bond lightning protection system to building grounding system.

G. Lightning Rod Cover Plate - Follow Ridge Vent Manufacturer's written instructions including:
   1. Attach conductor cable and air terminal to 'Lightning Rod Cover Plate' specified in Section 07 7100 - Roof Specialties at locations as per Shop Drawings Submittal.
   2. Apply elastomeric joint sealant as specified in Section 07 9200 around washer.
   3. Hook side of 'Lightning Rod Cover Plate' without conductor cable to bottom of ridge vent and rotate into place.
   4. Install conductor cable typically behind deflector.
   5. Fasten 'Lightning Rod Cover Plate' to Ridge Vent with four (4) zip screws provided by Ridge Vent Manufacturer as shown written instructions.
   6. Follow same procedure for rest of 'Lightning Rod Cover Plates' as shown on Shop Drawings.

## 3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.

C. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.

**END OF SECTION**

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## SECTION 26 4300
## SURGE PROTECTIVE DEVICES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for equipment controllers.

### 1.02 RELATED REQUIREMENTS

A. Section 26 0500 - Common Work Results for Electrical.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 2416 - Panelboards.

D. Section 26 4113 - Lightning Protection for Structures.

E. Section 32 8423 - Underground Sprinklers.

### 1.03 ABBREVIATIONS AND ACRONYMS

A. SPD: Surge Protective Device.

### 1.04 REFERENCE STANDARDS

A. IEEE C62.11 - Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV) 2020.

B. MIL-STD-220 - Method of Insertion Loss Measurement 2009c (Validated 2019).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

E. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

### 1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

### 1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
   1. UL 1449.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Closeout Submittals:
   1. Project Record Documents: Record actual connections and locations of surge protective devices.
   2. Warranty Documentation: Final, executed copy of Warranty.

### 1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

### 1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

### 1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

### 1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum ten year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Field-installed, Externally Mounted Surge Protective Devices:
   1. ABB/GE: www.geindustrial.com/#sle.
   2. Advanced Protection Technologies, Inc (APT): www.aptsurge.com/#sle.
   3. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com/#sle.
   4. Schneider Electric; Square D Brand Surgelogic Products: www.surgelogic.com/#sle.
   5. Emerson: www.emerson.com
   6. Eaton – Cooper Crouse-Hinds MTL formerly Atlantic Scientific: www.adventpowerprotection.com.

### 2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mounted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):
   1. 208Y/120V System Voltage: Not more than 800 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.
   2. Outdoor locations: Type 4.

### 2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:
   1. Protection Circuits: Field-replaceable modular or non-modular.
   2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
   3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
   4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
   5. Diagnostics:
      a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
      b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
      c. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.
   6. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

F. Install surge protective device in knock-out of junction box installed on bottom of automatic sprinkler

G. If the surge protector is not integrally installed, install as close as possible to the device being protected.

### 3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

**3.04 CLEANING**

A. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

**SECTION 26 5100**
**INTERIOR LIGHTING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Fluorescent emergency power supply units.

F. Lamps.

G. LED replacement lamps.

H. LED retrofit luminaire conversion kits.

### 1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0500 - Common Work Results for Electrical.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 0918 - Remote Control Switching Devices: Remote controls for lighting, including network lighting controls, programmable relay panels, and remote control switching relays.

G. Section 26 0923 - Lighting Control Devices.

H. Section 26 5600 - Exterior Lighting.

### 1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C78.377-2015 - American National Standard for Electric Lamps: Specification for the Chromaticity of Solid State Lighting Products.

C. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts; 2017.

D. ANSI/IES RP-16-10 - Nomenclature and Definitions for Illuminating Engineering.

E. Federal Communications Commission (FCC): Code of Federal Regulations (CFR): FCC 47 CFR Part 18, ‘Industrial, Scientific, and Medical Equipment'.

F. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2019).

G. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements; 2011, with Amendment (2015).

H. IEC 61000-3-2:2005 - Electromagnetic Compatibility (EMC) - Part 3-2: Limits for Harmonic Current Emissions (Equipment Input Current <= 16 A per phase).

I. IEC 61347-1 ED. 2.2 B:2012 - Lamp Controlgear - Part 1: General and Safety Requirements.

J. IEC 61347-2-13 - Controlgear for Electric Light Sources - Safety - Part 2-13: Particular Requirements - Electronic Controlgear for LED Light Sources; 2024.

K. IEC 61547 ED. 2.0 B:2009 - Equipment for General Lighting Purposes - EMC Immunity Requirements.

L. IEC 62384:2006 - D.C. or A.C. Supplied Electronic Control Gear for LED Modules - Performance Requirements.

M. IEC 62386-101 ED.1.0 B:2009 - Digital Addressable Lighting Interface - Part 101: General Requirements - System.

N. IEEE C62.41.1 - IEEE Standard Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (Reaffirmed 2008).

O. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

P. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

Q. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

R. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

S. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

T. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

U. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

V. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.

W. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

X. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Y. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Z. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

AA. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

BB. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

CC. UL 1598 - Luminaires; Current Edition, Including All Revisions.

DD. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

EE. UL 1993 - Self-Ballasted Lamps and Lamp Adapters; Current Edition, Including All Revisions.

FF. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Ballasts and Drivers:
      a. Manufacturer's published product data on dimensions, ratings, catalog numbers and identification of products and accessories for products included for project. Include performance data.
      b. Provide fixture type(s) list for each specific ballast/driver.
      c. Provide wiring diagrams as needed for special operation or interaction with other system(s).
      d. Qualification Statements: Provide experience compliance documentation and compliance documentation with UL / ULC requirements.
   3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
   4. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.

D. Certificates for Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Final, executed copy of Warranty on drivers.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

## 1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Regulatory Agency Sustainability Approvals: Meet UL / ULC requirements.

C. Qualifications. Requirements of Section 01 4000 apply but not limited to following:
   1. Manufacturer with five (5) years experience in manufacture of dimmable electronic lighting drivers.
   2. Provide experience documentation.

D. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with a minimum of three years documented experience.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

### 1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

### 1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for LED luminaires, including drivers.

## PART 2 PRODUCTS

### 2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 6000 - Product Requirements.

### 2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Product Options: When several lighting fixtures are specified by name for one use on Drawings, select any one of those specified. Do not mix fixtures from different manufacturers specified for one use.

H. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
   4. Provide fixtures with 0-10 V Dimming drivers.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

K. Fixtures shall be fully assembled complete with necessary wiring, sockets, lamps, reflectors, ballasts, auxiliaries, plaster frames, recessing boxes, hangers, supports, lenses, diffusers, and other accessories essential for complete working installation.

### 2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free lead calcium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Housing: Painted steel.

E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. Lamps: Designed for wet locations and with full vertical and horizontal adjustment.

G. Provide low-voltage disconnect to prevent battery damage from deep discharge.

H. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   3. Provide compatible accessory wire guards where indicated.
   4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

I. Manufacturers:
   1. Refer to light fixture schedule provided by Owner's Representative.
   2. Substitutions: See Section 01 6000 - Product Requirements.

**2.04 DRIVERS**

A. Manufacturers:
   1. General Electric Company/GE Lighting; _____: www.gelighting.com/#sle.
   2. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
   3. OSRAM Sylvania, Inc; _____: www.osram.us/ds/#sle.
   4. Philips Lighting North America Corporation; _____: www.usa.lighting.philips.com/#sle.

B. Drivers - General Requirements:
   1. Provide drivers containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide drivers complying with all current applicable federal and state ballast efficiency/efficacy standards.
   3. Electronic /Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

C. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
   3. 4-wire (010V DC Voltage Controlled) Dimming Drivers.
   4. Design Criteria:
      a. Driver must be able to operate for ±10 percent supply voltage of 120V through 277VAC at 60Hz.
      b. Driver to be UL / ULC recognized under component program and shall be modular for simple field replacement. Drivers that are not UL / ULC recognized or not suited for field replacement will not be used.
      c. Driver shall have ability to provide no light output when analog control signal drops below 0.5 V, o. Control deadband between 0.5V and 0.65V shall be included to allow

for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

d. Range and Quality: LED dimming to be equal in range and quality to commercial grade incandescent dimmer:
   1) Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in commercial environment.

e. Inrush Current: Driver must limit inrush current as follows:
   1) Minimum Requirement: Meet or exceed NEMA 410 driver inrush standard of 430 amps per 10 amps load with maximum of 370 amps² per second.
   2) Preferred Requirement: Meet or exceed 30mA²s at 277VAC for up to 50 watts of load and 75A at 240µs at 277VAC for 100 watts of load.

f. Withstand up to 1,000 volt surge without impairment of performance as defined by IEEE C62.41.1 Category A.

g. Light Output: No visible change in light output with variation of ±10 percent line voltage input.

h. Harmonic Distortion:
   1) Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements at full output.
   2) THD shall at no point in dimming curve allow imbalance current to exceed full output THD.

i. Automatic Adaptation:
   1) Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance.
      (a) Adjustment of forward LED voltage, supporting 3V through 55V.
      (b) Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1 mA.
      (c) Adjustment for operating hours to maintain constant lumens (within 5 percent) over 50,000 hour design life of system, and deliver up to 20 percent energy savings early in life cycle.

j. Light Quality:
   1) Over entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 - 1 percent light output and step to 0 percent where indicated. Driver shall respond similarly when raising from 0 percent to 100 percent.
   2) Drivers to track evenly across multiple fixtures at all light levels, and shall have input signal to output light level that allows smooth adjustment over entire dimming range.
   3) Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within dimming range from 100-0.1 percent luminaire shall have:
      (a) LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.
      (b) Minimum Requirement: Flicker index shall less that 5 percent at all frequencies below 1000 Hz.
      (c) Preferred specification: Flicker index shall be equal to incandescent, less that 1 percent at all frequencies below 1000 Hz.

k. Control Input:
   1) 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:
      (a) Must meet IEC 60929 ED. 4.0 B Annex E for General White Lighting LED drivers.

(b) Connect to devices compatible with 0 to 1 0V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at low end of 0.3V. Limit number of drivers on each 0-1 0V control output based on voltage drop and control capacity.
(c) Control relays or contactors and transformers for up to six circuits.
(d) Sensor controller with HIGH, LOW, and DEADBAND adjustments.

2) Digital (DALI Low Voltage Controlled) Dimming Drivers:
(a) Must meet requirements of IEC 62386-101 ED.1.0 B.

3) Integral Dimmer Driver for replacement lamps:
(a) LED Driver shall not cause shadows.
(b) LED Driver shall be line voltage controlled and shall be compatible with any universal dimmer.

5. Manufacturers:
a. eldoLED America, San Jose, CA www.eldoled.com.
b. OSRAM Sylvania, Danvers, MA or OSRAM Sylvania LTD, Mississauga, Ontario Canada www.Sylvania.com.
c. Philips Lighting Co, Somerset, NJ www.lighting.philips.com/nam or Philips Lighting Canada, Scarborough, ON (416) 292-3000.

**2.05 EMERGENCY POWER SUPPLY UNITS**

A. Manufacturers:
1. Beghelli, Miramar, FL www.beghelliusa.com.
2. Dual-Lite, Cheshire, CT www.dual-lite.com.
3. Iota Engineering, LLC: www.iotaengineering.com/#sle.
4. Lithonia Lighting: www.lithonia.com/#sle.
5. Signify Emergency Lighting/Bodine: www.bodine.com/#sle.
6. Eaton-Cooper Industries/Sure-Lites; www.cooperlighting.com
7. McPhilben / Day-Brite Lighting, Tupelo, MS www.mcphilben.com.
8. Substitutions: See Section 01 6000 - Product Requirements.
9. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by a single manufacturer.

B. Description: Self-contained emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Compatibility:
1. Drivers: Compatible with electronic, standard magnetic, energy saving, and dimming AC drivers, including those with end of lamp life shutdown circuits.

D. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

E. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.

F. Factory installed in lighting fixture, or field installed to same standards. Components shall be fully concealed and easily accessible for maintenance or replacement.
1. Install in ballast channel of fixture with charging indicator light and test switch mounted on fixture end, or visible and accessible through lens.

G. Linear Lighting Fixtures:
1. Battery pack shall operate one (1) lamp at approximately 600 lumens initially and 60 percent minimum of initial lumens after ninety (90) minutes.
2. Charger shall be capable of full recharge in twenty four (24) hours.

H. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

I. Accessories:
   1. Provide compatible accessory remote combination test switch/indicator light where indicated.

J. Battery Packs in Freezers/Coolers:
   1. Operating range shall be minus 20 deg C to 55 degrees C.
   2. Shall operate one lamp of Fluorescent lighting fixture at approximately 1000 lumens initially at 25 deg C and 60 percent minimum of initial lumens after ninety (90) minutes.
   3. Charger shall be capable of full recharge in twenty four (24) hours.
   4. Manufacturers:
      a. Bodine Co Inc: B50 Cold-Pak.
      b. Iota Engineering Co: ICE-80.
      c. Substitutions: See Section 01 6000 - Product Requirements

## 2.06 LAMPS

A. Manufacturers:
   1. Osram Sylvania; _____: www.sylvania.com/#sle.
   2. Philips Lighting North America Corporation; _____: www.usa.lighting.philips.com/#sle.

B. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

C. Other Lamps:
   1. Manufacturers:
      a. General Electric.
      b. North American Philips.
      c. Osram/Sylvania.

D. LED Lamps and Fixtures:
   1. Replacement Lamps shall have minimum efficiency of 90 lm / W per LM 79.
   2. Integral LED Lamps shall have minimum efficiency of 100 lm / W per LM 79.
   3. Provide minimum rated life of 50,000 per LM 80 and LM 70 standards.
   4. Color Temperature: 3,500 K.
   5. Fluorescent 4' T8 and T12 lamps shall be retrofitted with type A or C LED retrofit tubes.

## 2.07 LED REPLACEMENT LAMPS

A. Description: Light-emitting diode (LED) self-ballasted lamps listed as complying with UL 1993; intended for replacement of existing lamps of other light source types, including but not limited to, incandescent, fluorescent, and high intensity discharge (HID); suitable for installation in luminaire to be retrofitted.

B. LED Estimated Useful Life:
   1. Calculated based on IES LM-80 test data.
   2. Fluorescent Lamp Replacements: Minimum of 50,000 hours at 70 percent lumen maintenance.
   3. High Intensity Discharge (HID) Lamp Replacements: Minimum of 50,000 hours at 70 percent lumen maintenance.

4. Incandescent Lamp Replacements: Minimum of 15,000 hours at 70 percent lumen maintenance.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A. Proceed with installation only when following ambient conditions can be maintained:
   1. Install when the temperature is between minus 4 deg F (minus 20 deg C) minimum and 122 deg. F (50 deg. C) maximum and relative humidity is ninety (90) percent, non-condensing.
   2. Protect from dust and excess moisture during installation.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

E. Provide required support and attachment in accordance with Section 26 0529.

F. Interface with Other Work:
   1. Coordinate with Sections under 09 5000 heading to obtain symmetrical arrangement of fixtures in acoustic tile ceiling as shown on Reflected Ceiling Plan in Contract.
   2. Coordinate with Sections under 09 9000 heading to ensure that light coves are properly painted before installation of light fixtures.
   3. In mechanical equipment rooms, coordinate locations of light fixtures with equipment locations to provide proper room illumination without obstruction. Suspend fixtures that must be mounted below pipes, ducts, etc, with chains or other Architect approved method.

G. Securely mount fixtures. Support fixtures weighing 50 lbs (23 kg) or more from building framing or structural members.

H. Fasten lay-in fluorescent fixtures to ceiling suspension system on each side with bolts, screws, rivets, or clips. In addition, connect lay-in fixtures with two (2) No. 12 gauge diagonal wires with three (3) turns each end; two (2) per fixture minimum to building framing or structural members. Connect to opposing corners of fixture. Wires may be slightly slack. Make final conduit connections to lay-in fluorescent fixtures with specified flexible conduit or flexible fixture whips.

I. Where fluorescent fixtures are shown installed end to end, provide suitable connectors or collars to connect adjoining units to appear as a continuous unit.

J. Where recessed fixtures are to be installed, provide openings, plaster rings, etc, of exact dimensions for such fixtures to be properly installed. Coordinate fixture installation with ceiling type and thickness. Terminate circuits for recessed fixtures in an extension outlet box near fixture and connect with specified flexible conduit.

K. Verify operation of track lighting system in Cultural Center, then remove and store track lighting fixtures as directed.

L. Dimmable LED Drivers:
   1. Installation of driver to meet Manufacturer's prescribed methods and instructions.

2. Meet Ambient Conditions requirements for installation.
3. Driver may be remote mounted up to 300 ft (90 m) depending on power level and wire gauge.
4. 0-10V input shall be protected from line voltage wire, and immune and output unresponsive to induced AC voltage on control leads.

M. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

N. Suspended Ceiling Mounted Luminaires:
1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

O. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

P. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Unless otherwise indicated, support pendants from swivel hangers.

Q. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

R. Install accessories furnished with each luminaire.

S. Bond products and metal accessories to branch circuit equipment grounding conductor.

T. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.
3. Wire so unit can be tested with lights on.
4. Wire so lamps are normally off and operate upon loss of normal building power.

U. Emergency Power Supply Units:
1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
3. Install lock-on device on branch circuit breaker serving units.
4. Wire so unit can be tested with lights on.
5. Wire so lamps in normal mode are switched off with other lighting in area. Connect unit to unswitched conductor of normal lighting circuit.

V. Install lamps in each luminaire.

W. T8 LED Replacement Lamps
   1. Furnish and install new tombstones.
   2. Refurbish the wiring in the fixture to match the wring specified by the lamp manufacturer.
   3. Self-diven lamps shall be furnished and wired to be fed from both ends of the lamp.

**3.03 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects. Repair scratches or nicks on exposed surfaces of fixtures to match original undamaged conditions.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

**3.04 ADJUSTING**

A. Aim and position adjustable emergency lighting unit lamps to maximize lighting of first 50 feet (15 meters) of egress path.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

**3.05 CLEANING**

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

**3.06 CLOSEOUT ACTIVITIES**

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

**3.07 PROTECTION**

A. Protect installed luminaires from subsequent construction operations.

**END OF SECTION 26 5100**

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**SECTION 26 5600**
**EXTERIOR LIGHTING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Poles and accessories.

D. Luminaire accessories.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 0500 - Common Work Results for Electrical.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0533.16 - Boxes for Electrical Systems.

F. Section 26 0918 - Remote Control Switching Devices.

G. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.

H. Section 26 5100 - Interior Lighting.

### 1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices current edition.

B. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 2013, with Editorial Revision (2022).

C. ANSI C82.4 - American National Standard for Lamp Ballasts - Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps 2017.

D. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts 2017.

E. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing 2017.

F. ANSI O5.1 - American National Standard for Wood Poles: Specifications and Dimensions 2022.

G. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).

H. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.

I. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).

J. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information 2019.

K. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.

L. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.

M. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities 2021.

N. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

O. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2000 (Reaffirmed 2006).

P. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2020.

Q. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. UL 1598 - Luminaires Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

E. 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.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Manufacturer's maintenance instructions: Provide operating instructions for following components of exterior lighting control systems. Include one copy in Operations and Maintenance Manual and deliver two additional copies at time of Owner's instruction.
         1) Photocells.
         2) Time Switches.
         3) Lighting Contactors.

# PART 2 PRODUCTS

## 2.01 LUMINAIRES

A. Materials:
   1. Exterior Fixtures:
      a. Finish shall be high quality polyester powder coating:
         1) Finish process shall consist of cleaning, electrostatically applying power coat, and thermal curing.
         2) Weather, scratch, UV, and fade resistant.
      b. Color shall be Manufacturer's standard white, natural aluminum, or medium bronze as selected by Architect before bidding.
      c. Acceptable Products:

1) As indicated on Fixture Schedule. Do not mix fixtures from different manufacturers for one use.
2) Equals as approved by Architect before bidding. See Section 01 6200.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Interface With Other Work:
1. Coordinate location of anchor bolts and conduit in concrete bases so pole will be properly mounted and centered on base.

### 3.02 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Instruction Of Owner:
1. Before Substantial Completion, meet with personnel designated by Owner to:
   a. Identify location of control system components.
   b. Explain operation of each component.
   c. Demonstrate adjustment capabilities of time clocks, including turning systems OFF at times other than sunrise and keeping systems OFF on days facility is closed.
   d. Set time clocks as directed.

**END OF SECTION**

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**SECTION 27 1116**
**COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Selection Includes But Is Not Limited To:
   1. Furnish and install communications cabinets, racks, frames, and enclosures as described in Contract Documents.

B. Related Requirements:
   1. Section 26 0526: 'Grounding And Bonding For Electrical Systems'.
   2. Section 27 1501: 'Communications Horizontal Cabling'.
   3. Section 27 4117: 'Video Systems'.
   4. Section 27 4118: 'Audio Systems'.

C. Products Installed But Not Furnished Under This Section:
   1. Cable Management, Vertical Cable Management, and Horizontal Cable Management.

### 1.02 REFERENCES

A. Association Publications:
   1. Building Industry Consulting Service International (BISCI):
      a. Information Technology Systems Installation Methods Manual (ITSIMM) (8th Edition).
      b. Telecommunications Distribution Methods Manual (TDMM) (14th Edition).
   2. Institute of Electrical and Electronics Engineers:
      a. IEEE 802.3, 'Standard for Ethernet'.
      b. IEEE 1100-2005, 'Recommended Practice for Powering and Grounding Electric Equipment'.

B. Reference Standards:
   1. National Fire Protection Association:
      a. NFPA 70, 'National Electrical Code (NEC)' (2020 or most recent edition adopted by AHJ).
   2. EIA/TIA 310D - Cabinets, Racks, Panels and Associated Equipment.
   3. UL - Underwriters Laboratories:
   4. ISO 9001:2000 - Quality Mangement Systems

### 1.03 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Provide Manufacturer's documentation and descriptive information on each piece of equipment to be used.

## PART 2 PRODUCTS

### 2.01 SYSTEMS

A. Manufacturers:
   1. Approved Manufacturers. See Section 01 6200:
      a. Atlas Sound, www.atlassound.com
      b. Lowell Manufacturing Co., www.lowellmfg.com
      c. Middle Atlantic Products, www.middleatlantic.com.

B. See ET, TA and TT sheets for specified manufactures, models, and accessories.

## PART 3 EXECUTION

### 3.01 INSTALLERS

A. Approved Installers:
   1. Approved installers in Section 27 5117 are to both furnish and install components of this section. See Section 01 4301. Installer requirements of Section 01 4301 applies.

## 3.02 INSTALLATION

A. Equipment Cabinet:
   1. See Section 27 4118 ‘Sound System’ for installation of Sound Equipment.

B. Equipment Cabinet:
   1. Install vent panels at top and bottom of equipment cabinets and between components where possible for maximum ventilation when equipment locations is not specified in Contract Drawings. Locate amplifiers at top of cabinet. Locate equalizers below amplifiers, separated by several vent panels.
      a. Follow manufactures recommendations.
   2. Securely fasten equipment plumb and square in place. Utilize all fastening holes in front of cabinet.
   3. Securely fasten in place equipment that is not rack mounted, including relays and other small components. Do not use sticky-back tape.
   4. Identification:
      a. Legibly identify user-operated system controls and system input / output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexan labels. Label equipment and controls within equipment cabinets using similar labels or printed labels from a label maker or laser printer.
      b. Affix label to rack panel inside cabinet listing name and telephone number of installer. Appropriate warranty instructions may be included.

C. Communications Racks, Frames and Enclosures:
   1. Racks shall be installed as per manufacturer’s recommendations.
   2. Floor racks shall be securely attached to concrete floor with 3/8 inch (9.5 mm) minimum hardware or as required by local codes.
   3. Place floor racks with 36 inches (900 mm) minimum clearance front and back from walls and 28 inches (710 mm) clear on one side of rack. When mounted in row, maintain 36 inches (900 mm) minimum from wall behind and in front of row of racks and from wall at each end of row.
   4. Install wall-mounted pivoting equipment racks in accordance with manufacturer's instructions at locations indicated on the Drawings.
      a. Adjust operating hardware to operate smoothly without binding.
   5. Install equipment racks plumb, level, square, and secure.
   6. Grounding:
      a. Racks shall be grounded to telecommunications ground bus bar as per Section 26 0526 ‘Grounding And Bonding For Electrical Systems’.
      b. Racks shall be grounded in accordance with TIA-607.
   7. Seismic Bracing:
      a. Comply with IBC and local seismic requirements for all equipment and conduit pathways.
   8. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with rack upon completion of installation.
   9. Mounted termination block fields shall be mounted on Terminal Board in Technology Room provided by Electrical as shown in Contract Documents.
      a. Wall mounted termination block fields shall be installed with lowest edge of Terminal Board.

## 3.03 FIELD QUALITY CONTROL

A. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with Contract Document requirements at no additional cost to Owner.

B. Protect racks from damage during construction

C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved

**END OF SECTION**

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**SECTION 27 1501**
**COMMUNICATIONS HORIZONTAL CABLING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish, install, and test communications horizontal cabling as described in Contract Documents including following:
      a. Cables and related terminations.
      b. Patch cords and modular connectors.
      c. Surface raceway and outlet poles.
      d. Support and grounding hardware.
      e. UTP Cable.
      f. UTP Patch cords.
      g. UTP Connector Modules.
      h. Installation and testing of Owner Furnished Network Equipment.

B. Related Requirements:
   1. Division 26: Raceways and surface boxes.
   2. Section 07 8400: 'Firestopping' for furnishing and installation of firestopping.
   3. Section 26 0526: 'Grounding And Bonding For Electrical Systems' for installation and termination.
   4. Section 27 1116: 'Communications Cabinet, Racks, Frames, and Enclosures'.
   5. Section 27 4117: 'Video Systems'.
   6. Section 27 4118: 'Audio Systems'.

C. Products Installed But Not Furnished Under This Section:
   1. Owner Furnished Network Equipment as specified on TT (Technology Telecommunication) and TA (Technology Audiovisual) Drawings as shown in Contract Documents including:
      a. Internet Firewall.
      b. ISP Modem.
      c. Network Switch.
      d. Wireless Access Port.

D. Related Requirements:
   1. Section 01 6400: Owner will provide Network Equipment as specified on TT (Technology Telecommunication) and TA (Technology Audiovisual) Drawings as shown in Contract Documents. Contract Documents establishes quality of materials and installation for information of Contractor, Architect, and Owner's Representatives. Design Criteria in PART 2 of this Section identifies Contractor's responsibility for Owner Network Equipment.

### 1.02 REFERENCES

A. Association Publications:
   1. Building Industry Consulting Service International (BISCI:
      a. Information Technology Systems Installation Methods Manual (ITSIMM) (8th Edition).
      b. Telecommunications Distribution Methods Manual (TDMM) (14th Edition).
      c. Information Transport Systems Installation Methods Manual (ITSIMM) (7th Edition)
   2. Institute of Electrical and Electronics Engineers:
      a. IEEE 802.3, 'Standard for Ethernet'.
      b. IEEE 1100-2005, 'Recommended Practice for Powering and Grounding Electric Equipment'.
   3. Telecommunications Industry Association:
      a. TIA TSB-162-B, 'Telecommunication Cabling Guidelines for Wireless Access Points' (Revision A, 2021).

B. Reference Standards:
   1. National Fire Protection Association:
      a. NFPA 70, ‘National Electrical Code (NEC)' (2023 or most recent edition adopted by AHJ).
   2. Canadian Standards Association:
      a. CSA C22.1-18, ‘Canadian Electrical Code, part I (21st Edition), safety standard for electrical installations.
   3. Telecommunications Industry Association:
      a. ANSI/TIA-568.1 ‘Commercial Building Telecommunications Infrastructure Standard’ (Revision D, 2019)
      b. ANSI/TIA-568.2, 'Balanced Twisted-Pair Telecommunications Cabling and Components Standards' (Revision D, 2018).
      c. ANSI/TIA-568.4 ‘Broadband Coaxial Cabling and Components Standard (Revision D, 2017)
      d. ANSI/TIA-606, 'Administration Standard for Telecommunications Infrastructure' (Revision C, 2017).
      e. ANSI/TIA-607, 'Telecommunications Bonding and Grounding (Earthling) for Customer Premises' (Revision D, 2019).
      f. ANSI/TIA-758, ‘Customer-Owned Outside Plant Telecommunication Infrastructure Standard' (Revision B, 2012).
      g. ANSI/TIA-1152, ‘Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling' (Revision A 2016).
   4. Underwriters Laboratories:
      a. UL 94: Standard for Test for Flammability of Plastic Materials for Parts in Devices and Appliances (March 2013 6th Edition).
         1) 94HB, ‘Horizontal Burn Test’.

## 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate with Project Manager and/or Facility Manager well in advance of Substantial Completion for installation of all Owner Furnished Network Equipment.

## 1.04 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Provide Manufacturer’s documentation, installation instructions, and descriptive information on each piece of equipment to be used.
   2. Shop Drawings:
      a. Provide sample of labeling system reflecting approved label scheme for cable installation for racks, cables, panels, and outlets.

B. Informational Submittals:
   1. Certificates:
      a. Provide Installer certificates of qualifications required.
   2. Design Data:
      a. Identification and labeling:
         1) Provide labeling system for cable installation to be approved by Owner.
            (a) Clearly identify all components of system: racks, cables, panels and outlets.
            (b) Designate cables origin and destination and unique identifier for cable within facility by room number and port count.
            (c) Racks and patch panels shall be labeled to identify location within cable system infrastructure.
      b. After system installation, provide documentation set to Consulting Engineer/Architect for approval.
   3. Tests And Evaluation Reports:

a. Submit documentation within ten (10) working days of completion of each testing phase. This is inclusive of all test results and record drawings.
b. Draft drawings may include annotations done by hand. Final copies of all drawings shall be submitted within thirty (30) working days of completion of each testing phase.
c. At request of Consulting Engineer, provide copies of original test results.

4. Field Quality Control Submittals:
   a. Architect will provide floor plans in paper and electronic formats on which record documentation information can be recorded.
5. Qualification Statements:
   a. Letter from Manufacturer certifying level of training and experience of Installer.

C. Closeout Submittals:
1. Include following information in Operations And Maintenance Manual specified in Section 01 7800:
   a. Operations and Maintenance Data:
      1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
   b. Warranty Documentation:
      1) Final, executed copy of Warranty.
   c. Record Documentation:
      1) Manufacturers documentation:
         (a) Manufacturer's literature or cut sheet.
      2) Tests and evaluation reports.
      3) As-built Documentation:
         (a) Provide record document to include cable routes and outlet locations.
         (b) Sequential number shall identify outlet locations.
         (c) Numbering, icons, and drawing conventions used shall be consistent throughout all documentation.
         (d) Provide labeling system information.

## 1.05 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. System shall meet approval of authority having jurisdiction (AHJ). NEC and State and/or local ordinances and regulations shall govern unless more stringent requirements are specified.
2. Meet all TIA/EIA commercial building wiring standards.
3. Meet Telecommunications Distribution Methods Manual (TDMM) (14th Edition) requirements for installation and testing.
4. All Networks shall be installed per applicable standards and manufacturer's guidelines.
5. Cable assemblies shall be UL / CE Listed and CSA Certified. Cables shall be a distinctive green or green/yellow in color, and all jackets shall be UL, VW-1 flame rated.
6. Grounding shall conform to all required Commercial Building Grounding and Bonding Requirements for Telecommunications, Electrical Codes, and Manufacturer’s grounding requirements.

B. Qualifications: Requirements of Section 01 4301 applies, but is not limited to following:
1. Manufacturer Qualifications:
   a. Provide single source for all products of system:
      1) KeyConnect by Belden.
      2) Netkey by Panduit.
      3) System 6 by Siemon.
      4) Uniprise Media 6 by CommScope.
2. Installers Qualifications:
   a. Approved and Certified by Manufacturer (installation and maintenance trained):
      1) Belden Certified System Vendor (CSV).

(a) Belden Certified LDS Partner.
2) CommScope Certified Business Partner.
(a) CommScope Certified LDS Partner.
3) Panduit Certified Installer (PCI).
4) Siemon Certified Installers (CI).
b. Three (3) year experience with similar projects. Provide documentation.

**1.06 WARRANTY**

A. Special Warranty:
1. Cabling System:
a. Provide warranty for permanent link cabling system to meet Category 6A standard requirements for structured cabling system for twenty (20) years.
2. Installer Warranty:
a. Installer guarantees that all work is in accordance with all express and implied requirements of Contract Documents, that all work is of good quality, and further warrants work and material for period of (1) year from date of substantial completion of project, unless longer period of time is specified in Contract. All work not conforming to these requirements, may be considered defective:
1) If, within one (1) year after substantial completion of work, or within such longer period of time as may be prescribed by law or by terms of any warranty in Contract, any of work is found to be defective or not in accordance with Contract, Installer shall at Installer cost correct it promptly after receipt of written notice from Owner.
2) Installer's obligation shall survive termination of Contract.
3) Owner shall give such notice within reasonable time after discovery of condition.
b. Installer warrants to Owner that all materials and equipment furnished under this Contract shall be new unless otherwise specified, free from faults and defects and in conformance with Contract Documents:
1) Contractor shall secure manufacturer's warranties and deliver copies thereof to Owner upon completion of work.
2) All such warranties shall commence from date of substantial completion and will not in any way reduce Installer's responsibilities under this Contract.
3) Whenever guarantees or warranties are required by specifications for longer period than one year, such longer period shall govern.
c. Installer will provide twenty (20) year minimum end to end manufacturer warranty.

**PART 2 PRODUCTS**

**2.01 OWNER-FURNISHED PRODUCTS**

A. Products. See Section 01 6200:
1. Owner Furnished Network Equipment as specified on TT (Technology Telecommunication) and TA (Technology Audiovisual) Drawings as shown in Contract Documents including:
a. Internet Firewall.
b. ISP Modem.
c. Network Switch(es).
d. Wireless Access Points.
2. Coordination:
a. Coordinate installation of all Owner Furnished Network Equipment including but limited to:
1) Installation and configure devices in accordance with Owner requirements.
2) Proper set-up of network equipment.
3) Owner Furnished internet service to building prior to final installation of AV and Voice Data Equipment.
4) Testing of network equipment.

## 2.02 SYSTEMS

A. Manufacturers:
   1. Approved Manufacturers and Products. See Section 01 6200:
      a. Belden, St. Louis, MO www.belden.com.
      b. Panduit Corporation, Tinley Park IL www.panduit.com.
      c. Systimax Solutions, a CommScope Company, Hickory, NC www.systimax.com.
      d. The Siemon Company, Watertown, CT www.siemon.com.

B. Design Criteria:
   1. Must install single manufacture as complete permanent link.
      a. Category 6A minimum compliance margin on all parameters beyond category 6 and Power Sum ACR out to 550 MHz.
   2. Entire Category 6 system to be provided by single approved Manufacturer throughout.
   3. Install structured cabling system that will be able to support interconnections to active telecommunications equipment for voice and data applications in multi vendor, multi product environment. Structured cabling system should adhere to TIA-568, TIA-606; TIA-607, and TIA-942 standards with respect to pathways, distribution, administration, and grounding of the system.
   4. Each room drop will consist of two drops each consisting of two terminations can be interoperable to accommodate either voice or data applications.
   5. Install, terminate, test, and guarantee each drop according to customer all applicable standards and customer preferences.
   6. Horizontal cables will be rated Category 6A (500 MHz) in performance and rated to comply with TIA-568 to connector outlets at Work Area. Horizontal cables will home run back to Technology Room (Entrance Facility / Main Cross Connect) and will terminate on individual Category 6A rated jacks to populate modular 48 port patch panel on open or flat patch panel inside enclosures. All cables will be patched at cutover as interconnection into floor serving active equipment using RJ45 modular equipment cables rated to Category 6A.
   7. Match additions to horizontal raceway to complete system according to TIA-568 where suspension and protection gaps exist.

C. Components – Work Area Subsystem:
   1. Provide connectivity equipment used to connect horizontal cabling subsystem and equipment in work area. Both copper and fiber media shall be supported. Connectivity equipment shall include following options:
      a. Patch (equipment) cords and modular connectors.
      b. Outlets and surface mount boxes.
      c. Surface raceway and outlet poles.
      d. Consolidation point / MUIO.
   2. Patch Cords and Modular Connectors:
      a. Match horizontal cabling medium and rating. Same Manufacturer shall provide modular connectors and patch cords. Total patch cord length at work area is not to exceed 10 feet (3.0 m).
      b. Copper Connectivity:
         1) Network Cabling System:
            (a) Provide for Work Area subsystem, including all modular connectors.
            (b) Modular connectors shall support of high-speed networks and applications designed for implementation on copper cabling.
            (c) Outlets shall utilize fully interchangeable and individual connector modules that mount side-by-side to facilitate quick and easy moves, adds and changes.
         2) Modular Connections:
            (a) Data Modules shall be Category 6A:

(b) Eight position modules required in all work areas and shall exceed connector requirements of TIA Category 6A standard.
(c) Prove termination cap with strain relief on cable jacket, ensure cable twists are maintained to within 1/8 inch (3 mm) and include wiring scheme label. Wiring scheme label shall be available with TIA-568 wiring schemes.
(d) Terminations shall use for TIA-568 wiring scheme.
(e) Modules shall terminate 4 pair 23 100-ohm solid unshielded twisted pair cable.
(f) Modules shall meet ISO 11801 standard including complying with intermateability standard IEC 60603-7 for backward compatibility.
(g) Category 6A modules shall have UL and CSA approval.
(h) Modules shall have ETL verified Category 6A performance and ISO 11801 Class E performance in both basic and channel links.
(i) Modules shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to outer jack contacts.
(j) Modules shall be able to be re-terminated minimum of 10 times and be available in 11 standard colors for color-coding purposes.
(k) Jack shall snap into all outlets and patch panels.
(l) Module shall include black base to signify Category 6A 500 MHz performance.

3) Patch Cords:
(a) Category 6A patch cords 'shall be factory terminated with modular plugs featuring one-piece, tangle-free latch design and strain-relief boots to support easy moves, adds, and changes.
(b) Constructed with Category 6A 23-AWG stranded UTP cable.
(c) Each patch cord shall be one hundred (100) percent performance tested at factory in channel test to ANSI/TIA Category 6A standard.
(d) Patch cords shall come in standard lengths of 3, 5, 7, 9, 14 and 20 feet (0.90, 1.50, 2.15, 2.75, 4.20 and 6.1 meters) and 6 standard colors of Blue or White.
(e) Provide one (1) each 8 feet (2.45 m) patch cord for 50 percent of terminated work station ports.

3. Outlets and Surface Mount Boxes:
a. Outlets and surface mount boxes shall support network system by providing high-density in-wall, surface mount cabling applications.
b. Provide faceplates for flush mount:
1) Outlets faceplates shall be manufactured from high-impact thermoplastic material with UL 94 flammability rating of 94 HB or better.

4. Copper Cable:
a. Design Criteria:
1) Performance exceeds all ANSI/TIA-568 Category 6A and ISO 11801 for Class E cable requirements.
2) ETL tested and verified for Category 6A component performance.
3) Conductors are twisted in pairs with four pairs contained in flame retardant PVC jacket separated by a spline.
4) Performance tested to 650 MHz.
5) Plenum (CMP) and non-plenum/riser (CMR) flame rated.
6) Maximum installation tension of 25 lbs (110 N).
7) Installation temperature range: 32 deg F (0 deg C) to 140 deg F (60 deg C).
8) Operating temperature range: 14 deg F (minus 10 deg C) to 140 deg F (60 deg C).
9) Cable diameter: Riser – 0.295 inch (7.49 mm) 0.260"; Plenum – 0.295 inch (7.49 mm).

10) Easy payout, reel-in-a-box and descending length markings on cable speed installation.
11) Supports following applications: Ethernet 10BASE-T, 100BASE-T (Fast Ethernet),1000BASE-T (Gigabit Ethernet), 10GBASE-T; 1.2Gb/s ATM; Token Ring 4/16; digital video; HDBaseTand broadband/baseband: PoE; PoE+; PoE++ .
12) Color shall be blue.

D. Horizontal Distribution Cabling:
1. General:
a. Horizontal distribution cabling system is portion of telecommunications cabling system that extends from work area telecommunications outlet/connector to horizontal cross-connect in Technology Room (Entrance Facility / Main Cross Connect).
1) Horizontal cabling in office should terminate in Technology Room (Entrance Facility / Main Cross Connect) located on same floor as Work Area being served.
2) Horizontal cabling is installed in star topology (home run).
3) Bridged taps and splices are not permitted as part of copper horizontal cabling.

E. Components – Technology Room (Entrance Facility / Main Cross Connect):
1. General:
a. Connect networking equipment to horizontal and backbone cabling subsystems:
1) Termination hardware (connectors and patch cords), racks, cable management products and cable routing products.
2) Cable termination hardware.
b. Terminate each horizontal or backbone cabling run using appropriate connectors or connecting blocks depending upon cable type:
1) Matching patch cords will be used to perform cross-connect activities or to connect into the networking/voice hardware:
(a) Category 6A Enhanced Unshielded Twisted Pair (UTP).
c. Four-pair Category 6 UTP cabling shall be terminated onto four-pair Category 6 module:
1) All modules shall be terminated using 568-B wiring scheme.
2) Eight position module shall exceed connector requirements of ANSI/TIA Category 6A.standard.
3) Jack termination to 4-pair, 100 ohm solid unshielded twisted pair cable shall be by use of forward motion termination cap and shall not require use of punchdown or insertion tool.
2. Rack, Cabinet, and Cabling Management Enclosure:
a. Cable Management:
1) Cable Management System shall be used to provide neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures.
2) Provide complete cable management system comprised of vertical and horizontal cable managers to manage cables on both front and rear of rack.
3) System shall protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.
b. Vertical Cable Management:
1) General:
(a) Vertical cable managers include components that aid in routing, managing and organizing cable to and from equipment.
(b) Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief.

2) Provide panels with universal design mounting to 19 inches (480 mm) rack and constructed of steel bases with PVC duct attached.
3) Covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

c. Horizontal Cable Management:
1) General:
(a) Horizontal cable managers include components that aid in routing managing and organizing cable to and from equipment.
(b) Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief.
2) Provide panels with universal design mounting to 19 inches (480 mm) rack and constructed of steel bases with PVC duct attached.
3) Duct fingers shall include retaining tabs to retain cables in place during cover removal.
4) Covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

3. Patch Cords:
a. Provide patch cords between modular patch panels configured as cross-connect or between patch panel and networking hardware when patch is used as interconnect. Provide one (1) each 3 feet (0.90 m) patch cord for each terminated patch panel port.
b. Provide patch cords as indicated on Drawings and Specifications as shown in Contract Documents. Ensure all devices are fully connected to network equipment.
c. Provide additional patch cords with appropriate length to connect all Owner provided internet enabled appliances (IEA) as specified on TT (Technology Telecommunication) and TA (Technology Audiovisual) Drawings as shown in Contract Documents.
d. Patch cords shall be factory terminated with modular plugs featuring one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes.
e. Construct patch cords with Category 6A 23-AWG stranded UTP cable.
f. Patch cords shall be one hundred (100) percent performance tested at factory in channel test to Category 6A standard.

4. Patch Panels:
a. Four-pair Category 6A UTP cabling shall be terminated onto four-pair-punch-down style connecting hardware mounted to rear of integral patch panels and routed to Category 6 modules on front face of patch panel.
b. Patch panels shall be universal for ANSI/TIA-568 wiring configurations.
c. Patch panels shall have removable 6-port design that allows 6-port module to be removed without disrupting other ports.
d. Integral cable tie mounts shall be included in panel for cable management on back of panel.
e. Port and panels shall be easy to identify with write-on areas and optional label holder for color-coded labels.
f. Rack mountable patch panels shall mount to standard 19 inches (480 mm) rack.

5. Grounding and Bonding:
a. Provide Telecommunications Bonding Backbone:
1) Ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has potential to act as current carrying conductor.
2) Install telecommunication Bonding Backbone independent of building’s electrical and building ground.
3) Designed in accordance with recommendations contained in TIA-607 Telecommunications Bonding and Grounding Standard.

b. All wires used for telecommunications grounding purposes shall be identified with green insulation:
    1) Non-insulated wires shall be identified at each termination point with wrap of green tape.
    2) All cables and bus bars shall be identified and labeled as required.

6. Firestopping: Furnish and install firestopping as per Section 07 8400.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. General:
1. Install communications system in accordance with Manufacturer's written instructions, and complying with applicable portions of NEC 'Standard of Installation'.

B. Work Area Outlets:
1. Cables shall be coiled in in-wall or surface-mount boxes if adequate space is present to house cable coil without exceeding Manufacturers bend radius.
    a. No more than 12 inches (300 mm) of UTP slack shall be stored in in-wall box, modular furniture raceway, or insulated walls.
    b. Excess slack shall be loosely configured and stored in ceiling above each drop location when there is not enough space present in outlet box to store slack cable.
2. Cables shall be dressed and terminated in accordance with TIA-568, Manufacturer's recommendations, and best industry practices.
3. Cables shall be bundled using Velcro straps at least 0.25 inch (6.35 mm) wide. Use of plastic wire ties or zip ties is not allowed on project.
4. Pair untwist at termination shall not exceed 0.125 inch (3.175 mm).
5. Bend radius of cable in termination area shall not be less than 4 times outside diameter of cable.
6. Cable jacket shall be maintained to within one inch (25 mm) of termination point.
7. Data / voice jacks, unless otherwise noted in Contract Documents, shall be located on each faceplate.
8. Horizontal Cabling:
    a. Data jacks in horizontally oriented faceplates shall occupy rightmost position(s).
    b. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

C. Horizontal Cross Connect:
1. Cables shall be dressed and terminated in accordance with ANSI/TIA-568, Manufacturer's recommendations, and best industry practices.
2. Pair untwist at termination shall not exceed 0.125 inch (3.175 mm).
    a. Bend radius of cable in termination area shall not be less than 4 times outside diameter of cable.
3. Cables shall be neatly bundled and dressed to their respective panels or blocks.
    a. Each panel or block shall be fed by individual bundle separated and dressed back to point of cable entrance into rack or frame.
    b. Cables shall be bundled using Velcro straps at least 0.25 inch (6.35 mm) wide. Use of plastic wire ties or zip ties is not allowed on project.
4. Cable jacket shall be maintained as close as possible to termination point.
5. Each cable shall be clearly labeled on cable jacket behind patch panel at location that can be viewed without removing bundle support ties.
    a. Cables labeled within bundle, where label is obscured from view shall not be acceptable.
6. Horizontal Cabling:
    a. A pull cord (nylon; 1/8 inch (3 mm) minimum) shall be co-installed with all cable installed in any conduit.

b. Cable raceways shall not be filled greater than required by TIA-569 maximum fill for particular raceway type.
c. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
d. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in enclosure intended and suitable for purpose.
e. Cable's minimum bend radius and maximum pulling tension shall not be exceeded.
f. If J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at 48 inch (1 200 mm) to 60 inches (1 500 mm) maximum intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
g. Horizontal distribution cables shall be bundled in groups of no more than 25 cables. Cable bundle quantities in excess of 25 cables may cause deformation of bottom cables within bundle and degrade cable performance.
h. Cables shall be bundled using Velcro straps at least 0.25 inch (6.35 mm) wide. Use of plastic wire ties or zip ties is not allowed on project.
i. Cable shall be installed above fire-sprinkler systems and shall not be attached to system or any ancillary equipment or hardware. Cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
j. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support cabling.
k. Cables shall be identified by self-adhesive label and meet requirements of TIA-606. Cable label shall be applied to cable behind faceplate on section of cable that can be accessed by removing cover plate.
l. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in run and at termination field.
m. Pulling tension on 4-pair UTP cables shall not exceed 25 lbf (111 N) for a four-pair UTP cable.

D. Vertical Outlet Pole And Surface Raceway:
1. Horizontal Cabling:
a. General:
1) Vertical outlet poles and Surface Raceway refers to surface raceway system used for branch circuit wiring and/or data network, voice, video and other low-voltage cabling. Surface raceway shall be used in solid wall applications or for applications where moves, additions and changes are very typical to workflow.
b. Raceway system shall consist of raceway, appropriate fittings and accessories to complete installation per electrical Contract Documents. Non-metallic surface raceway is to be utilized in dry interior locations only as covered in Article 352, part B of the NEC, as adopted by the NFPA and as approved by the ANSI.

E. Copper Termination Hardware:
1. Cables shall be dressed and terminated in accordance with TIA-568, Manufacturer's recommendations, and best industry practices.
2. Pair untwist at termination shall not exceed 0.125 inch (3.175 mm).
a. Bend radius of cable in termination area shall not be less than 4 times outside diameter of cable.
3. Cables shall be neatly bundled and dressed to their respective panels or blocks.
a. Each panel or block shall be fed by individual bundle separated and dressed back to point of cable entrance into rack or frame.
b. Cables shall be bundled using Velcro straps at least 0.25 inch (6.35 mm) wide. Use of plastic wire ties or zip ties is not allowed on project.
4. Cable jacket shall be maintained as close as possible to termination point.
5. Each cable shall be clearly labeled on cable jacket behind patch panel at location that can be viewed without removing bundle Velcro support straps.

a. Cables labeled within bundle, where label is obscured from view shall not be acceptable.

F. Grounding System:
1. Where required, Telecommunications Bonding Backbone shall be designed and/or approved by qualified Installer.
2. Follow requirements of TIA-607.

G. Seismic Bracing:
1. Comply with IBC and local seismic requirements for all equipment and conduit pathways.

H. Identification and Labeling:
1. Apply machine generated approved labeling for racks, cables, panels and outlets:
a. Designate cables origin and destination and unique identifier for cable by room name and/or number and port count.
b. Racks and patch panels shall be labeled to identify location within cable system infrastructure.
2. Place labeling within view at termination point on each end.
3. Outlet, patch panel and wiring block labels shall be installed on, or in, space provided on device.
4. See Contract Drawings for labeling scheme.
5. Conform to IP addressing assignments as listed in Attachment 'FACILITIES ZONE IP ADDRESS ASSIGNEMENT TABLE'.
a. See Attachment 'FACILITIES ZONE IP ADDRESS ASSIGNEMENT TABLE' for 'IP Address Assignments.

## 3.02 FIELD QUALITY CONTROL

A. Field Tests:
1. Provide testing upon completion of installation.
a. General:
1) Testing to be in accordance with ANSI/TIA standards and Manufacturer's system warranty guidelines and best industry practice.
(a) If any of these are in conflict, discrepancies shall be brought to attention of Architect/Consulting Engineer for clarification and resolution.
b. Cables and termination hardware:
1) Test complete system for defects in installation.
2) Verify cabling system performance under installed conditions according to requirements of TIA-568:
(a) All pairs of each installed cable shall be verified prior to system acceptance.
(b) Any defect in cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure one hundred (100) percent useable conductors in all cables installed.
c. Copper channel testing:
1) All twisted-pair copper cable links shall be tested for compliance to requirements of TIA-568 for appropriate Category of cabling installed.
2)
d. UTP Cables and Links testing:
1) UTP cabling channel must be tested at swept frequencies up to 500 MHz for internal channel performance parameters as defined in IEEE 802.3 and ANSI/TIA-568. Certifications shall include following parameters for each pair of each cable installed:
(a) Wire map (pin to pin connectivity).
(b) Length (in feet or millimeters).
(c) Near End Crosstalk (NEXT).
(d) Far End Crosstalk (FEXT).

(e) ELFEXT.
(f) Attenuation/Crosstalk Ration (ACR).
(g) Return Loss.
(h) Propagation Delay.
(i) Delay Skew.
(j) Test equipment shall provide electronic and printed record of these tests.

2) Test each pair of cable for opens, shorts, grounds, and pair reversal.
(a) Correct short or grounded and reversed pairs.
(b) Examine open and shorted pairs to determine if problem is caused by improper termination.
(c) If termination is proper, tag bad pairs at both ends and note on termination sheets.
(d) If horizontal cable contains bad conductors, remove and replace cable.

e. Testing Equipment:
1) Comply with requirements of TIA-568.
(a) Appropriate level III tester shall be used to verify Category 6 cabling systems.
2) UTP Cables and Links test equipment:
(a) Category Four Approved Testing Equipment. See Section 01 6200 for definitions of Categories:
(b) Fluke Networks DTX2-8000 or DTX2-5000 with latest firmware version.
(c) Viava Certifier 10G or Certifier 40G w/ latest firmware.
(d)
(e)
(f) Equipment shall be calibrated in accordance with manufacture requirements, ANSI/TIA standards and warranty requirements.

f. Re-Testing:
1) Consulting Engineer may request ten (10) percent random field re-test to be conducted on cable system, at no additional cost to Owner, to verify documented findings.
(a) Tests shall be repeat of those defined above.
(b) If findings contradict documentation submitted, additional testing can be requested to extent determined necessary by Consulting Engineer, including one hundred (100) percent re-test at no additional cost to Owner.

g. Tests And Evaluation Reports:
1) Printouts generated for each cable by wire test instrument shall be submitted as part of documentation package. Installer may furnish this information in electronic form.
(a) Media shall contain electronic equivalent of test results as defined by the Section along with software necessary to view and evaluate test reports.
2) Submit documentation within ten (10) working days of completion of each testing phase. This is inclusive of all test results and record drawings.
3) Draft drawings may include annotations done by hand. Final copies of all drawings shall be submitted within thirty (30) working days of completion of each testing phase.
4) If requested by Consulting Engineer, provide copies of original test results.

h. Test Documentation:
1) Provide electronic format documentation within three (3) weeks after completion of project.
2) Documentation shall be clearly marked on outside front cover with following:
(a) "Project Test Documentation".
(b) Project name.
(c) Date of completion (month and year).
3) Test results shall include following:

(a) Record of test frequencies.
(b) Cable type.
(c) Conductor pair and cable (or outlet) I.D.
(d) Measurement direction.
(e) Reference setup.
(f) Crew member name(s).
(g) Test equipment name, manufacturer, model number, serial number, software version.
(h) Last calibration date:
(i) Unless Manufacturer specifies more frequent calibration cycle, annual calibration cycle is required on all test equipment used on project.
(j) Document shall detail test method used and specific settings of equipment during test as well as software version being used in field test equipment.

B. Non-Conforming Work: Non-conforming work as covered in General Conditions applies, but is not limited to following:
1. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced at no additional cost to Owner.
2. Any defect in cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure one hundred (100) percent useable conductors in all cables installed at no additional cost to Owner.
3. Correct deviation and repeat applicable testing at no additional cost to Owner.
4. Correct any work found defective or not complying with Association Publications and TDMM requirements at no additional cost to Owner.
   a. Document all problems found and corrective action taken.
   b. Include both failed and passed test data.

**END OF SECTION 27 1501**

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**SECTION 27 4117**
**AUDIO SYSTEMS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete and operational sound system as described in Contract Documents including:
      a. Complete systems for amplifying sound signals from microphones and media source equipment and distributing them to loudspeakers at various locations.
   2. Assist Audiovisual Consultant with final inspection and equalization of system and provide necessary test equipment for audio system and partition noise isolation tests if applicable. Correct problems found at time of final inspection of system.

B. Audiovisual Consultant will perform final inspection, system balance, equalization, and instruct local leaders in operation of system.

C. Products Installed But Not Furnished Under This Section:
   1. Webcast/Streaming Capable Device.

### 1.02 RELATED REQUIREMENTS

A. Section 26 0533.13 - Conduit for Electrical Systems

B. Section 26 0533.16 - Boxes for Electrical Systems.

C. Section 27 4118 - Video Systems.

### 1.03 REFERENCE STANDARDS

A. ANSI/AVIXA 10 - Audiovisual Systems Performance Verification 2013.

B. ANSI/Infocomm 2M - Standard Guide for Audiovisual Systems Design and Coordination Processes 2010.

C. ANSI/Infocomm 10 - Audiovisual Systems Performance Verification 2013.

D. AVIXA RP-C303.01 - Recommended Practices for Security in Networked Audiovisual Systems 2018.

E. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition 2022.

F. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition 2019.

G. BICSI TDMM - Telecommunications Distribution Methods Manual, 14th Edition 2020.

H. ANSI/AVIXA 4:2 , ‘Audiovisual Systems Energy Management'(2012 Edition)..

I. IEEE 1100 - IEEE Recommended Practice for Powering and Grounding Electronic Equipment 2005.

J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.

L. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards 2009, with Addendum (2016).

M. TIA-569 - Telecommunications Pathways and Spaces 2019e.

N. TIA-606 - Administration Standard for Telecommunications Infrastructure 2021d.

O. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises 2019d.

P. TIA-758, ‘Customer-Owned Outside Plant Telecommunication Infrastructure Standard' (Revision B, 2012).

Q. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate final inspection schedule of both audio and video systems before Audiovisual Consultant's final inspection.

B. Schedule:
   1. After completion of audio system installation of this section, Installer to perform Field Testing before Audiovisual Consultant Final Inspection of audio system.
   2. Notify Audiovisual Consultant two (2) weeks minimum before Audiovisual Consultant's final inspection as specified in Field Quality Control in Part 3 of this specification.
   3. Deliver metal speaker grilles, which are to be painted to match ceiling, before attachment to speakers and before installation of audio system.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Informational Submittals:
   1. Special Procedure Submittals:
      a. Provide itemized list of equipment to be supplied.
      b. Provide proposed labeling for system components.
   2. Qualification Statement:
      a. Installer:
         1) Provide Qualification documentation as requested by Engineer/Architect including:
            (a) List of Projects requested.
            (b) List of certified technician(s) with dates of training courses completed.
            (c) Other items outlined section 1.06 b.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Equipment Manufacture’s manual:
            (a) Audio system operation and maintenance instructions.
            (b) List of equipment provided, including portable equipment, showing make, model, and serial number.
      b. Warranty Documentation:
         1) Include copy of final, executed warranty.
      c. Record Documentation:
         1) Software and Programming: Copies of all manufacturers’ software used for programming various components and functions of the system shall be furnished to the Owner:
            (a) Original audio processor program files, source codes and compiled codes used for system control, audio setup and any other computerized functions of system including screen layout generation, configuration and layouts and any other related computer files shall also be furnished to Owner.
            (b) In each and every case, all programming, code generation, configuration files, layout files and any other software and/or code written and generated of setup and operation of this system are property of Owner of system and not of Audiovisual Consultant, Contractor or Integrator.

## 1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. System shall be installed in accordance with applicable standards, requirements, and recommendations of International Building Code, National Electrical Code and all local authorities having jurisdiction.

B. Qualifications:
   1. Installer. Requirements of Section 01 4000 applies, but not limited to following:
      a. Approved Installers:
         1) Installers are to furnish and install components of audio system and meet qualification requirements.
         2) Approval subject to agreement process for Pre-Approval Installers.
      b. Alternate Installer(s):
         1) Firm specializing in performing work of this section:
            (a) Minimum three (3) years of successful installation experience of AV system projects of comparable size, and complexity required for this project. Audio systems must have included complete installation and setup work and must have been completed by factory trained and certified technician.
            (b) Firm successfully completed minimum of three (3) projects in past two (2) years before bidding. including at least one (1) project designed by an audio consultant.
            (c) Firm shall own sufficient hand tools, vehicles, scaffolding, power tools, and so forth to install the system in a timely and proper manner.
            (d) Firm shall be a factory authorized dealer for the majority of equipment ot be furnished, and able to execute manufacturers warranties for installed equipment.
            (e) Firm must employ personnel which have:
               (1) At-least 5 years recent experience in sound reinforcement, who will be assigned to the project.
               (2) Satisfactorily completed formal industry technical training including Syn-Aud-Con: Course 50, AVIXA: CTS-I, or CTS-D, and manufacturers training for equipment installed under this section including Q-sys: Level 1 and 2.
            (f) Firm Shall be active in industry professional societies such as NSCA, AES, AVIXA, etc.
            (g) Firm shall own appropriate test equipment for audio and network equipment installed under this section, including but not limited to notebook computer, test and measurement microphone(s), SPL Meter, Level II Cable Certifier, etc.
            (h) Firm shall be directly responsible for the completion of the work, and shall not sub-contract it to another contractor who would not otherwise meet these qualification requirements.
            (i) Firm shall have sufficient staff, physical plan, and inventory to provide timely warranty and post-warranty service as required by the specifications.
            (j) Comply with specifications and Contract Documents.
         2) Submit documentation of compliance of qualifications before bid to Architect or Owner’s Representative.
      c. Same Approved Installer shall furnish and install components of Section
      d. Same Approved Installer shall furnish and install components of Section 27 1000 - Structured Cabling and 27 4118 - Video Systems.
      e. Same Approved Installer shall furnish and install components of Section 27 1000 - Structured Cabling.
      f. Same Approved Installer shall furnish and install components of Section 27 4118 - Video Systems.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:

1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Provide secure location protected from weather in cool, dry location, out of direct sunlight in compliance with Manufacturer's instructions and recommendations.
   2. Keep materials free from dirt and foreign matter.

**1.08 WARRANTY**

A. Special Warranty:
   1. Provide complete warranty repair or replacement for one (1) year at no cost to Owner, except in case of obvious abuse.
   2. If failure causes audio system to be inoperative or unusable for its intended purpose, Installer, when notified of problem shall repair system within five (5) days so it will be operational and usable. If defective components cannot be repaired in time, furnish and install temporary loaner equipment as required.
   3. If failure causes Chapel or Cultural Center audio system to be inoperative or unusable for its intended purpose, Installer, when notified of problem before Wednesday, shall repair system so it will be operational and usable by following Sunday. If defective components cannot be repaired in time, furnish and install temporary loaner equipment as required.
   4. Honor component warranties for term established by Manufacturer, if greater than one (1) year.

**PART 2 PRODUCTS**

**2.01 OWNER-FURNISHED PRODUCTS**

A. Approved Products. See Section 01 6000:
   1. Network Streaming Equipment as specified on contract drawings. Drawings as shown in Contract Documents. including projectors and video monitors.
   2. Steaming Equipment, as shown on contract drawings.
   3. Coordinate installation of all Owner Furnished Network Streaming Equipment with Div 27 4133 Installer.

**2.02 SYSTEM**

A. Shall Consist of components, as specified on Project Drawings. See Section 01 6000.

B. Performance:
   1. Capabilities:
      a. Installations with audio DSP shall meet following performance parameters:
         1) From 100 Hz to 2 kHz, flat within plus or minus 2 dB.
         2) Above 2 kHz, slope down along an approximate 3 dB per octave slope to 8 kHz.
      b. No noise, hum, RFI pickup or distortion shall be audible under normal operating conditions.
      c. Audio systems shall reproduce program material at level of 80 to 85 dBA without audible distortion.
      d. All input levels shall be pre-set so system may be operated without going into feedback under normal conditions.
      e. Seat-to-seat variations in the 4kHz octave band shall not exceed plus or minus 2 dB in the Chapel or Cultural Center.
      f. Sound masking system:
         1) Sound masking system shall provide adequate speech privacy in Corridor when set between 42 dBA and 46 dBA at ear-height under speaker so conversation in Office at slightly raised voice levels cannot be understood in Corridor.
         2) Speakers and masking generator, as specified on Technology drawings.

C. System Requirements:
   1. General:

a. Provide complete and fully functional audio systems using materials and equipment of types, sizes, ratings, and performances as indicated in equipment list in accompanying drawings:
    1) Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information.
    2) Coordinate features of materials and equipment so they form integrated system with components and interconnections matched for optimum performance of specified functions.
2. Provide all wire, cable, and connectors as required to complete installation of all systems as designed and specified.

D. Equipment And Materials:
1. Provide equipment selected from equipment list on drawings, or as substituted following proscribed substitution process, using all solid state components fully rated for continuous duty at ratings indicated or specified.
2. Select equipment for normal operation on input power supplied at 105 130 V, 60 Hz.

E. Operation
1. Summary: Set up and program the system so room combining and signal routing is automatically executed based on control commands issued by system switches and partition infra-red sensors.
2. Program system using owner provided template files. Make modifications to files as indicated on project drawigns to provide turn-key system.

## PART 3 EXECUTION

### 3.01 INSTALLERS

A. Approved Installers. See Section 01 6000:
1. Qualifications:
    a. Meet qualification requirements as specified in Quality Assurance in Part 1 of this specification.
2. General Communications: (801) 266-5731.
3. Marshall Industries: (801) 266-2428.
4. Poll Sound: (801) 261-2500.
5. Summit Fire & Security (PST): (801) 649-6696.

### 3.02 EXAMINATION

A. Verification Of Conditions:
1. Verify compliance with following items before beginning work of this Section:
    a. No cables spliced.
    b. Isolated ground run back to electrical panel from all equipment cabinets.
    c. Specified conduit, cables, speaker enclosures and equipment cabinets are properly installed.
    d. Location and angle of speaker cabinets.
2. Ensure that no solid structural or decorative member impedes sound propagation from speakers and that no member with cross section greater than 3/4 inch (19 mm) is placed in front of speakers.
3. Verify installation of fiberglass insulation in field-fabricated speaker enclosures.
4. Verify proper functionality for all system components being reused or remaining untouched.

### 3.03 INSTALLATION

A. General:
1. Install system in accordance with NFPA 70, NFPA 72, and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Mounting And Securing Equipment:

1. Equipment shall be firmly secured in place unless requirements of portability dictate otherwise.
2. Fastenings and supports shall be adequate to support their loads with safety factor of at least three (3) times weight of equipment being installed.
3. Any structural mounting that is not able to meet this requirement due to specific nature of equipment, manufacturer's requirements or limitations of facility, shall not be installed without prior approval of Engineer.
4. Install all boxes, equipment, hardware, and other materials plumb, level, and square.

C. Millwork:
1. Install technology equipment and support equipment in millwork in neat and cosmetically dressed out manner.
2. Install technology equipment and support equipment in podium and other millwork in neat and cosmetically dressed out manner.
3. Saw cuts, holes and recesses into laminates and woodwork shall be straight.
4. Radius and circular cuts shall be consistent, and all uneven surfaces shall be corrected. This shall include use of moldings, grommets, bushings, laminates, and wood products as required to dress out installation of equipment.
5. Install equipment and panels in technology racks using matching screws, hardware and grommets.
6. Install equipment and panels in technology racks and podiums using matching screws, hardware and grommets.

D. Speakers:
1. Maintain uniform polarity in speakers and wiring.
2. Employ no positive stop in rotation of speaker volume controls. Controls shall be capable of continuous rotations in either direction.
3. Mount transformers with screws securely to speaker brackets or enclosures. Adjust torsion springs as necessary to securely support speaker assembly.
4. Neatly mount speaker grilles, panels, connector plates, control panels, etc., tight, plumb, and square unless indicated otherwise on drawings.
5. Provide brackets, screws, adapters, springs, rack mounting kits, etc, recommended by manufacturer for correct assembly and installation of speaker assemblies and electronic components.
6. Line factory-fabricated speaker back boxes with one inch (25 mm) minimum fiberglass if not done by Back box Manufacturer.
7. Speaker Back Boxes shall be secured to structure using 12 ga (2.7 mm) minimum seismic safety cables.

E. Technology:
1. Provide sufficient ventilation for adequate cooling of equipment.
2. Install vent rack panels in unused spaces. Install vent panels at top and bottom and above each power amplifier.
3. Securely fasten equipment plumb and square in place. Where equipment is installed in rack cabinets, utilize all fastening holes and cove open spaces with perforated panels.
4. Securely fasten relays and small components. Do not use sticky-back tape for fasteners.
5. Install balancing transformer on each unbalanced input or output that connects to devices outside equipment cabinet, or that connects to balanced input or output within equipment cabinet.
6. Connect powered components to 120 VAC outlets on transient voltage surge suppressors. Do not connect to outlets on other components.
7. Leave sufficient service loops to uniform length on cables to allow operation of system with chassis outside cabinet.
8. Equipment shall be held firmly in place with proper types of mounting hardware as recommended and/or supplied by manufacturer:

a. Mounting hardware provided with equipment shall be used when practical. This shall include, but not be limited to, front and rear rack rails, angle brackets and rack mount kits.
b. Equipment shall be installed so as to provide reasonable safety to operator.

F. Cables, Wires, And Connectors:
1. Cables:
a. Cable and wire shall be new and unspliced.
b. Splicing:
1) Splicing of cables and conductors is expressly prohibited in any location other than equipment racks.
2) Splicing of control and speaker level conductors shall be accomplished via punch block or terminal strip connections only.
c. Additional cable length shall be provided at all connector locations. Duplex box, junction box, and floor box locations shall be installed with sufficient cable length behind cover plates to permit wiring maintenance and connector replacement in the future.
d. When cable runs utilize vertical cable raceways located within walls, acoustic integrity of walls shall be maintained:
1) Cables that pass-through cover plates of junction boxes and raceways, through slab-to-slab walls, and through conduit lines shall be properly gasketed and sealed. Acoustic material shall be restored or replaced.
e. Separation between system cables and other services shall be maximized to prevent and/or minimize potential for electro-magnetic interference (EMI):
1) Provide at least 12 inches (305 mm) separation from electrical lines whenever feasible.
2) Where separation is unavoidable, distribution cables shall cross other services at right angles whenever practical to minimize EMI.
f. Do not install signal cables on top of light fixtures, ceiling speakers, projection screens, HVAC controls or sensing devices, fire safety and sprinkler system detection technology, or any other technology or mechanical equipment.
g. Do not lay cables directly on top of T-bar grid ceiling tiles:
1) Support cables installed outside of conduit at 4 feet (1.20 m) maximum intervals from building structure.
2) Do not utilize support wires from other trades or systems.
h. Install system cables shall not block access to other equipment or services, across removable service panels and/or in any other manner to prohibit routine maintenance of HVAC systems, fire safety equipment and building mechanical control systems.
i. Inter-rack cabling:
1) Inter-rack cabling shall be neatly laced, dressed, strain relieved and adequately supported.
2) Inter-rack cables shall be grouped according to signals being carried to reduce signal contamination. Separate groups shall be formed for following:
(a) Power.
(b) Control.
(c) Video.
(d) Audio cables carrying signals less than -20 dBM.
(e) Audio cables carrying signals between -20 dBM and +20 dBM.
(f) Audio cables carrying signals over +20 dBM.
j. Power cables, control cables, and high-level cables shall be run on left side of equipment racks as viewed from rear. All other cables shall be run on right side of all equipment racks as viewed from rear.
k. Cables, except video cables which must be cut to electrical length, shall be cut to length dictated by cable run.

l. Terminal blocks, boards, strips or connectors, shall be furnished by installer for all cables which interface with racks, cabinets, consoles, or equipment modules. Affix terminal blocks, boards, strips or connectors to equipment racks using screws only. Double sided tape will not be accepted.
m. Shields for audio cables shall be grounded at input end only of various equipment items on system to prevent potential for ground loops.
n. Shields for microphone cables shall be grounded at both ends to allow Phantom Power to pass.
o. Where AV cable is installed in areas that are exposed to view of end users, install AV cable and associated power cables inside nylon braided sleeving (wire loom):
    1) Examples of such areas include, but are not limited to cables installed to projectors and monitors, and cables installed to devices in/on lecterns such as touch panels and document cameras.
    2) Where security cables are specified for physical security to such devices, install the specified security cables inside nylon braided sleeving along with AV cables.

2. Wiring and Cabling:
    a. Comply with industry standard circuit polarity and loudspeaker wiring polarity. No cables shall be terminated with polarity reversal between connectors at either end.
    b. System wire, after being cut and stripped, shall have wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No bare wire ends shall be accepted.
    c. Do not place any wires and cables for this system in any conduit, raceway, wire way or cable tray that is used for mechanical systems of building.
    d. Route all cable and wiring within equipment racks, cabinets and millwork according to function, separating wires of different signal levels (microphone, line level, amplifier output, AV, control, etc.) by as much distance as possible. Neatly arrange, harness and bundle all cable with velcro straps.
    e. After completion of wiring and cable installation, all trough and box covers shall be notched out and grommeted for clearance of various cable bundles, (i.e., separate audio, video, and control). Panel covers shall be screwed back in place and all gaskets shall be restored or replaced.

3. Connectors:
    a. Provide connectors of type and quality as detailed in Contract Drawings and/or as required to meet minimum bandwidth requirements of equipment to which connectors are terminated. Overall quantity of connectors shall not be limited by quantities indicated in Contract Drawings and shall be provided as required.
    b. No connectors shall be installed in non-accessible locations or used for splicing cables. Connectors shall be new.
    c. Connectors shall incorporate strain relief mechanisms which firmly grip the jacket of connected cables.
    d. Connectors shall be properly polarized to prevent improper seating.
    e. Connectors shall provide appropriate electrical characteristics for circuitry to which they are attached.
    f. Exposed conductors inside of equipment racks shall be dressed with heavy duty neoprene heat-shrink tubing.
    g. Heat-shrink type tubing shall be used to insulate and dress ends of all wire and cables including separate tube for ground or drain wire.
    h. Solder connections shall be made with rosin-core solder. Temperature controlled soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns, gas or butane, or temperature unregulated irons shall be used on job site.
    i. Mechanical connections shall be made with approved crimp lugs of correct size and type for connection. Wire nuts shall not be permitted except inside speaker enclosures. Each connector shall be attached with proper size controlled-duty-cycle ratcheting crimp tool approved by manufacturer.

j. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on job site. Presence of such tools on job site shall constitute evidence of mechanical connections made with unauthorized tools and shall provide sufficient grounds for rejection of all mechanical connections in system, and will be considered non-conforming work.

G. Equipment Cabinet:
1. Install vent panels at top and bottom of equipment cabinets and between components where possible for maximum ventilation. Locate amplifiers at top of cabinet. Locate equalizers below amplifiers, separated by several vent panels.
2. Securely fasten equipment plumb and square in place. Utilize all fastening holes in front of cabinet.
3. Securely fasten in place equipment that is not rack mounted, including relays and other small components. Do not use sticky-back tape.
4. Install balancing / isolation transformer when balanced and unbalanced components are connected.
5. Wire XLR-type connections with pin 2 hot, pin 1 shield.
6. Connect powered components to 120 VAC outlets on voltage suppressor power bars. Do not connect to outlets on other components.
7. Identification:
   a. Legibly identify user-operated system controls and system input / output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexan labels. Label equipment and controls within equipment cabinets using similar labels or printed labels from a label maker or laser printer.
   b. Affix label to rack panel inside cabinet listing name and telephone number of installer. Appropriate warranty instructions may be included.

H. Identification And Labeling:
1. Cables, regardless of length, shall be identified with machine-printed wrap-around labeling system at both ends:
   a. These labels shall be self-laminating to ensure durability.
   b. Label format used shall be equal, or better than, system detailed.
2. There shall be no unmarked cables any place in system.
3. Marking codes used on cables shall correspond to codes provided with submittals, and/or written documentation of 'Record Drawings'.
4. Connectors, controls, equipment components, terminal blocks and equipment racks are to be permanently labeled in format approved during submittal process.
5. Equipment labels are to be permanently engraved in metal. Alternative method shall be approved during submittal process only.
6. Clearly and permanently label all jacks, controls, connections, and so forth. Embossed or printed label tape shall not be used and is considered unacceptable for this system. Attach labels with double stick tape as required.
7. Labeling shall be completed prior to acceptance of final system.

I. Grounding:
1. Provide equipment grounding connections for audio system as indicated. Tighten connections to comply with tightening torques specified in UL 486A-486B to assure permanent and effective grounds.
2. Ground equipment, conductor, and cable shields to eliminate shock hazard and to eliminate ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5 ohm ground at main equipment location. Measure, record, and report ground resistance.
3. Provide grounding conductor with green insulation between as indicated on Contract Drawings. Comply with IEEE and TIA standards.

J. Pulpit:

1. Install pulpit microphone pre-amplifier to be accessible below lectern. Do not alter factory supplied microphone cable and connectors.
2. Install pulpit microphone so tip of microphone head is 2 inches (50 mm) inside edge of lectern when microphone is tilted down to maximum extent.

K. Seismic Bracing:
1. Comply with IBC and local seismic requirements for all equipment and conduit pathways.

**3.04 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Field Tests:
1. Installer Testing:
a. After completion of installation but before inspection by Audiovisual Consultant, perform following:
1) Conduct system tests and make necessary corrections for proper system operation including, but not limited to, following:
(a) Output level uniformity.
(b) Polarity.
(c) Shock, strain excited hum, and oscillation.
(d) Clipping, hum, noise, and RFI in all system configurations.
(e) Speaker line impedances.
(f) Loose parts and poor workmanship or soldering.
2) Sweep speaker systems with high-level sine wave or 1/3 octave pink noise source. Correct causes of buzzes or rattles related to speakers or enclosures. Notify Contractor and Audiovisual Consultant of external causes of buzzes or rattles.
3) Rough Balance: Balance system well enough that it can be used for meetings before final inspection.
b. Complete documentation required by Audiovisual Consultant and submit to consultant within five (5) days of Substantial Completion.

C. Field Inspections:
1. Audiovisual Consultant Inspection And Equalization:
a. Coordinate final inspection schedule with Audiovisual Consultant two (2) weeks minimum before Consultant's final inspection.
b. Have copy of Installer redlined documents sent to Audiovisual Consultant two (2) weeks minimum to before field inspection.
c. Have loose equipment (microphones, cables, etc.) available at time of inspection.
d. Assist Audiovisual Consultant in final inspection of completed system.
e. Assist Audiovisual Consultant in noise isolation testing of folding partitions and office doors.
f. Provide following test equipment in good working order:
1) Laptop computer:
(a) capable of running current DSP configuration software
(b) with active commercially available anti-virus software
2) 1/3 octave real-time audio spectrum analyzer with SPL meter, and precision microphone.
3) Digitally generated random pink noise generator, 20Hz-20KHz, minimum two (2) hour repetition rate or ten (10) minutes minimum of equivalent signal recorded on compact disc.
4) Direct reading audio impedance meter, minimum three (3) frequencies, and ten (10) percent accuracy.
5) Digital Volt-Ohmmeter.
6) Audio oscillator, variable frequency, 20Hz-20KHz.
7) MP3 player with pre-recorded speech and music program material.

8) Necessary chargers, cables, test leads, adapters, and other accessories for test equipment.
9) Tools and spare parts for making adjustments and corrections to system.
10) Level II Cable certifier, or cable certifier report.

g. Correct minor items so Audiovisual Consultant may certify satisfactory completion during his visit.

D. Non-Conforming Work:
1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.
a. Provide all materials requested by consultant to document rededication of punchlist items not remedied during system commissioning.

E. Manufacturer Services:
1. Provide services of factory authorized service representative to supervise field assembly and connection of components and pretesting, testing, and adjustment of system.

**3.05 CLEANING**

A. Waste Management:
1. All work areas are to be kept clean, clear and free of debris at all times.
2. Disposal of rubbish, debris, and packaging materials to Contractor provided Dumpster.
3. Disposal of rubbish, debris, and packaging materials in proper manner.

**PART 4 MEETINGHOUSE SOUND SYSTEM FUNCTIONALITY**

**4.01 EACH OF THE SOUND SYSTEM(S) SHOULD FUNCTION AS INDICATED.**

**4.02 SOUND MASKING SYSTEM**

A. Sound masking speakers located in outside of offices, should be tapped at 1W, and be calibrated to produce X SPL when measured at 5'10" AFF. Masking speakers located in offices, shall be tapped at ½ W. SPL is determined by calibration of public area sound masking speakers.

**4.03 CHAPEL SYSTEM**

A. 'CP' shall consist of touch panel installed in Bishop's Pedestal and shall function as follows:

B. When in the Off state, the touch panel shall contain a single On/Off button. Chapel inputs shall be muted, and power to the amplifier shall be off. Pressing the On/Off Button shall cause the system to turn on.
1. Power to the amplifier shall be engaged. While the amplifier is booting, Touch panel shall display a message indicating the system is powering on, and system chapel outputs shall remain muted.

C. When the amplifier is fully powered on, Chapel outputs shall be unmuted, and the Touchpanel shall display standard "System On" Page. This page shall consist of:
1. Momentary Pulpit Up and Down Buttons, which shall raise and lower the pulpit respectively when pressed.
2. Chapel Volume Slider, which shall start at center position, and allow the user to raise or lower the room volume by 5 dB.
3. Power On/Off Button, which when pressed shall return the system to its original off state.
4. In systems with video systems, a Program Audio Button, which when pressed shall unmute audio the program audio feed to the room, and add a second slider to the panel for controlling the program audio level.
a. Pressing the program audio button again, shall mute the program audio, remove the program audio slider form the panel display, and return the program audio slider to its pre-set level.
b. Program audio level shall allow adjustment of up to 60dB, and when at its lowest position, shall mute the program output.

D. Each time the system is turned on, the system will shall:

1. Restore the system to its default settings, and,
2. return chapel volume slider to middle sound level, which corresponds to its default sound level.
3. After the system is fully ready, the touch panel shall display the main operations screen
4. Shall not cause an audible pop to be heard over the sound system

E. Volume Level Control

F. Default Configuration
1. The defaults sound level for the system is 4Db below the feedback level.
2. The number of open Mics (NOM) shall be 3.
3. The pulpit, and sacrament microphones shall be set to always open.
4. Auxiliary feeds from both the video system, and the audio system shall not be included in the NOM calculation.

**4.04 CULTURAL HALL SYSTEM**

A. The cultural hall system consists of multiple sections. From the available sections, the section closest to the chapel shall be equipped with a 'CC' or main controller, and shall be referred to as the main section. The next largest available section may be equipped with a 'CC2' or secondary controller, and shall be referred to as the secondary. Each section shall be electronically separated, or combined via an Infrared sensor, which shall be mounted such that it reliably detects weather the operable partition doors are open or closed.

B. The Cultural hall 'CC' device shall consist of a touchpanel installed on the wall and shall function as follows:
1. When Cultural Hall system(CC) is off, and the associated section is separated (separating door(s) are closed) form the chapel, or it is connected to the Chapel (door(s) are open)and the chapel is off, CC shall display the "CC System Off" page.
2. When associated section is connected to chapel (door(s) are open) and Chapel system is on or starting, CC shall display a message indicating "CC is connected to Chapel. To use system turn off chapel system or close one or more doors separating the rooms.
3. The CC System Off pages shall consist of a single "System On" Button. When pressed, the system shall engage power to the amplifier, unmute the cultural hall audio outputs, and display the "CC Auto Mode Page".
4. The CC Auto Mode Page shall consist of a "Power Off" button, and a "CC Manual" Button.
   a. Pressing the "Power Off" button shall return the CC panel and its associated room to their off states.
   b. Pressing the "CC Manual" button shall display the CC Manual page.
5. The "CC Manual Mode" page shall consist of the same System On/Off Buttons available on the "Auto Mode" page, and volume sliders for each audio inputs in the associated cultural hall section, or any of its combined sections (door(s) open between then). This excludes the chapel, which inputs are never broken out for individual control. Since the number of available inputs will vary depending on which other sections are combined, the number of sliders will vary. Multiple "CC Manual Mode" pages may be necessary.
   a. Each slider shall allow for 40dB of gain adjustment, ranging from -30dB to +10dB from teach inputs nominal level. When the slider is set to -30dB, the system shall fully mute the associated input.
6. Pressing the "CC Auto" Button shall return the panel to the "CC Auto Mode" page. return system to Auto mode operation, and reset all manual volume sliders to nominal levels and positions.
7. Pressing "CC Off" Button from this screen shall immediately return associated cultural all sections to their off state, display the "CC System Off" page, and return all manual volume sliders to their nominal volume levels and positions.

C. When included in a system, CC2 shall function in the same manner as the "CC" control panel.
1. When cultural hall sections containing CC and CC2 are combined, both panels shall show the same pages, and information at the same time.

2. When separated (one or more partition doors between them are closed) each panel shall operate independently of the other, enabling only control of the audio inputs and outputs in their respective sections.

D. If at any time, the chapel system is turned on while connected to the one or more of the cultural hall sections containing a CC or CC2 control. Connected controls shall immediately display the "CC connected to Chapel" page, Mute their inputs, and route chapel audio to any cultural hall sections connected to the chapel.
   1. Any systems which were operation in Manual Mode, shall additionally return sliders to their nominal positions, and levels.

E. Room Combining
   1. Cultural hall sections and the chapel shall be combinable, by opening the folding partition doors, and triggering the IR sensors. Combinable sections are assigned a priority, when a lower priority section is combined with a higher priority section, controls in the lower priority section shall be disabled, and the sound mix from the higher priority section shall be routed to the lower priority section.

**4.05 ASSISTIVE LISTENING SYSTEM (ALS)**

A. The assistive listening system, uses RF frequencies to broadcast an audio feed to compatible receivers. When the chapel sound system is on, the system broadcasts the chapel sound. If the cultural hall system is on, and the chapel is not, the system will broadcast the sound form the cultural hall.

**4.06 INDEPENDENT ROOM SYSTEMS**

A. Rooms with independent systems include one or mic or auxiliary input jacks, and a wall controller consisting if an audio switch, and volume control.
   1. Switch shall select which audio signal is heard in the room. Available signals are Local sound, or overflow.

**4.07 PERIMITER ROOM SYSTEMS, AND THE PERIMITER FEED**

A. The perimeter room systems shall include a speaker and volume control knob, in each meetinghouse foyer area, serving area, as well as other selected rooms. These systems shall be connected to the perimeter feed.

B. When active, the perimeter feed shall transmit sound to the connected systems and rooms. Connected systems shall include independent room systems, Assistive Listening Systems, and Foyer systems, the perimeter feed shall default to the chapel sound whenever the chapel system is on. If the cultural hall system is on, when the chapel system is off, the perimeter feed shall transmit the cultural hall system. When both systems are off, the perimeter feed shall transmit no sound signals.

**4.08 STREAMING AUDIO**

A. Stake Centers shall be equipped with XLR inputs and outputs for the purpose of allowing users to alter the default webcast audio feed. The AV rack shall include connections for 2 Choir microphones, an Organ Output, a Chapel Mix output, and a Webcast Input. The chapel organ sound shall be routed from the chapel organ to the chapel organ output. The sound heard through the overflow speakers in the chapel shall be routed to the Chapel Mix Output. The Choir Microphone outputs shall be cabled directly to the Choir microphone inputs on the rostrum.

B. The system shall include a webcast output connected directly from the DSP processor to the Webcast device. By Default, the system shall route the Chapel Mix to webcast device. If signal is detected on the Webcast In, the system shall automatically route that signal to the webcast device instead of the default chapel mix. Users shall be able to connect a manual mixer to the provided connections on CP1, and automatically route a custom mix to the webcast device.
   1. Webcast output (3,5mm plug type connection) shall be set to provide a line level (commercial). adjusted for a typical talker at the pulpit, while chapel slider is in its default position.

**END OF SECTION**

**SECTION 27 4118**
**VIDEO SYSTEMS**

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK:

A. Furnish and install complete and operational video system as described in Contract Documents including:
   1. Line amplifiers, video and audio processors, video switchers, cable, connectors and ancillary equipment necessary to successful reception and distribution of video and audio signal from selected reception device (video stream).
   2. Installation and testing of Owner Furnished Network and Streaming Equipment.

B. Assist Audiovisual Consultant with final inspection of system and provide necessary test equipment. Correct problems found at time of final inspection of system.

C. Audiovisual Consultant will perform final inspection and instruct local leaders in operation of system.

D. Products Installed But Not Furnished Under This Section:
   1. Owner Furnished Network Streaming Equipment as specified on TA and TT (Technology Audiovisual and Technology Telecommunications) Drawings as shown in Contract Documents.

### 1.02 RELATED REQUIREMENTS

A. 01 6000 - Product Requirements.
   1. Owner will Furnish Network Encoding Streaming Equipment as specified on TA (Technology Audiovisual) Drawings as shown in Contract Documents. Contract Documents establish quality of materials and installation for information of Contractor, Architect, and Owner's Representatives. Design Criteria in PART 2 of this Section identifies Contractor’s responsibility for Owner Network Equipment.

B. 03 1000 - Concrete Forming and Accessories: Installation of concrete base pier for base pipe.

C. 09 9113 - Exterior Painting: Finish painting of base pipe.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0533.16 - Boxes for Electrical Systems.

F. 26 0536 - Cable Trays for Electrical Systems.

G. 27 1000 - Structured Cabling: Communications Cabinet, Racks, Frames, and Enclosures.

H. Section 27 4117 - Audio Systems.

I. Instructions to Owner by Audiovisual Consultant.

### 1.03 REFERENCE STANDARDS

A. ANSI/Infocomm 2M - Standard Guide for Audiovisual Systems Design and Coordination Processes 2010.

B. ANSI/Infocomm 3M - Image System Contrast Ratio 2011.

C. ANSI/Infocomm 4 - Audiovisual Systems Energy Management 2012.

D. ANSI/Infocomm 10 - Audiovisual Systems Performance Verification 2013.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

F. AVIXA RP-C303.01 - Recommended Practices for Security in Networked Audiovisual Systems 2018.

G. BICSI TDMM - Telecommunications Distribution Methods Manual - 14th Edition 2020.

H. IEEE 1100 - IEEE Recommended Practice for Powering and Grounding Electronic Equipment 2005.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.

K. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards 2009, with Addendum (2016).

L. TIA-569 - Telecommunications Pathways and Spaces 2019e.

M. TIA-606 - Administration Standard for Telecommunications Infrastructure 2021d.

N. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises 2019d.

O. TIA-758, ‘Customer-Owned Outside Plant Telecommunication Infrastructure Standard' (Revision B, 2012).

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with Owner’s Representative (Project Manager and/or Facility Manager) well in advance of Substantial Completion for installation of all Owner Furnished Network Streaming Equipment.

B. Coordinate final inspection schedule of both audio and video systems before Audiovisual Consultant's final inspection.

C. After completion of video system installation of this section, Installer to perform Field Testing before Audiovisual Consultant Final Inspection of audio system.

D. Notify Audiovisual Consultant two (2) weeks minimum before Field Inspection specified in Field Quality Control in Part 3 of this specification.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Informational Submittals:
   1. Manufacturer Reports: Itemized list of equipment to be supplied.
   2. Special Procedure Submittals: Provide itemized list of equipment to be supplied and proposed labeling for system components.
   3. Installer Qualifications:
      a. Provide Qualification documentation as requested by Engineer/Architect including list of Projects requested and list of certified technician(s) with dates of training courses completed.

C. Closeout Submittals:
   1. Project Record Documents:
      a. Record actual locations of outlets, devices, and cable routing.
      b. Equipment manufacturer’s manuals and warranty information.
   2. Operation Data:
      a. Instructions for setting and tuning channels.
      b. System operation and maintenance instructions.
      c. List of equipment provided, including portable equipment, showing make, model, and serial number.
      d. Leave clear plastic sheet protector in rear of equipment cabinet with system drawings and documentation.
      e. Set-up files and settings for video equipment.
   3. Warranty Documentation: Final, executed copy of Warranty.

## 1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70 and cable television utility company.

B. Regulatory Agency Sustainability Approvals:

1. System shall be installed in accordance with applicable standards, requirements, and recommendations of International Building Code, National Electrical Code and all local authorities having jurisdiction.

C. Qualifications:
   1. Installer. Requirements of Section 01 4000 applies, but not limited to following:
      a. Approved Installers:
         1) Installers are to furnish and install components of video system and meet qualification requirements.
         2) Approval subject to agreement process for Pre-Approval Installers.
      b. Alternate Installer(s):
         1) Firm specializing in performing work of this section:
            (a) Minimum three (3) years of successful installation experience of AV system projects of comparable size, and complexity required for this project. Audio systems must have included complete installation and setup work and must have been completed by factory trained and certified technician.
            (b) Firm successfully completed minimum of three (3) projects in past two (2) years before bidding.
            (c) Firms must have certified technician that has successfully completed all relevant training courses recommended by manufacturers and is proficient with all specified equipment of this section.
            (d) Comply with specifications and Contract Documents.
         2) Submit documentation of compliance of qualifications before bid to Architect or Owner's Representative.
      c. Same Approved Installer shall furnish and install Section 27 4117 - Audio Systems

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Provide secure location protected from weather in cool, dry location, out of direct sunlight in compliance with Manufacturer's instructions and recommendations.
   2. Keep materials free from dirt and foreign matter.

## 1.08 WARRANTY

A. Provide complete warranty repair or replacement for one (1) year at no cost to Owner, except in case of obvious abuse.

B. If failure causes audio system to be inoperative or unusable for its intended purpose, Installer, when notified of problem shall repair system within five (5) days so it will be operational and usable. If defective components cannot be repaired in time, furnish and install temporary loaner equipment as required.

C. If failure causes Chapel or Cultural Center audio system to be inoperative or unusable for its intended purpose, Installer, when notified of problem before Wednesday, shall repair system so it will be operational and usable by following Sunday. If defective components cannot be repaired in time, furnish and install temporary loaner equipment as required.

D. Honor component warranties for term established by Manufacturer, if greater than one (1) year.

# PART 2 PRODUCTS

## 2.01 OWNER-FURNISHED PRODUCTS

A. Products. See Section 01 6000:
   1. Network Equipment as shown on TT601 (Technology) Drawings.
   2. Steaming Equipment, as shown on TA601 and TA602
   3. Wall Mounted Televisions, and support brackets

B. Coordinate installation of all Owner Furnished Network Streaming Equipment including but not limited to:
   1. Installation and configure devices in accordance with Owner requirements.
   2. Mounting and setup of wall-mounted televisions
   3. Proper set-up of Network Streaming Equipment.
   4. Testing of Streaming Equipment, by originating a webcast.

## 2.02 DESIGN CRITERIA

A. Video distribution system refers but is not limited to following components:
   1. Line amplifiers, video and audio processors, video switchers, cable, connectors and ancillary equipment necessary for successful reception and distribution of video and audio signal from the selected reception device.
   2. Owner Furnished streaming and network equipment.

B. Intent of this specification is that
   1. Audiovisual signals shall be broadcast and available within the originating receiving system will receive broadcasts from network streaming device and currently in use by Church and provide video, audio, and video signal distributed properly throughout system.

C. System shall be fully function and complete video distribution system using equipment and materials of types, sizes, rating, and performances as indicated in Contract Drawings and following requirements:
   1. Equipment and materials shall comply with manufacturers' standard design and construction in accordance with published product data and in compliance with referenced standards.
   2. Equipment and materials are to be integrated with components and connections functions at optimum performance.
   3. Setup shall be optimized for display resolutions matching owner furnished display devices.

# PART 3 EXECUTION

## 3.01 INSTALLERS

A. Approved Installers - See Section 01 6000:
   1. Meet qualification requirements as specified in Quality Assurance in Part 1 of this specification.
   2. General Communications: (801) 266-5731.
   3. Marshall Industries: (801) 266-2428.
   4. Poll Sound: (801) 261-2500.
   5. Summit Fire & Security (PST): (801) 649-6696.

## 3.02 EXAMINATION

A. A. Verification Of Conditions:
   1. Verify compliance with following items before beginning work of this Section:
      a. No cables spliced.
      b. Specified cables and equipment cabinets are properly installed.
   2. Verify all site conditions are in compliance with requirements for proper installation and function of video system work.
   3. Verify proper functionality for all system components being reused or remaining untouched.

## 3.03 INSTALLATION

A. Owner Furnished Equipment:
   1. Network Streaming Equipment:
      a. Install and setup Owner Furnished Network Streaming Equipment.
   2. Extended Display Identification Data (EDID):
      a. Set all specified EDID capable devices for Owner Furnished Display Device resolutions and sync signals including installation and setup.

B. General:
   1. Install system in accordance with NFPA 70, NFPA 72, and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

C. Equipment Cabinet:
   1. File smooth exposed rough edges after cutting and drilling. Do not allow sharp screws to protrude from cabinet.
   2. Install vent panels at top and bottom of equipment cabinets. In addition, install vent panels between components, where possible, for maximum ventilation.
   3. Securely fasten equipment plumb and square in place. Utilize all fastening holes in front of cabinet.
   4. Securely fasten in place equipment that is not rack mounted, including relays and other small components. Do not use sticky-back tape.
   5. Install balancing/isolation transformer when balanced and unbalanced components are connected.
   6. Wire XLR-type connections with pin 2 hot, pin 1 shield.
   7. Connect powered components to 120 VAC outlets on voltage suppressor power bars. Do not connect to outlets on other components.
   8. Identification:
      a. Legibly identify user-operated system controls and system input/output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexan labels. Label equipment and controls within equipment cabinets using similar labels or printed labels from a label maker or laser printer.
      b. Affix label to rack panel in cabinet listing name and telephone number of installer. Appropriate warranty instructions may be included.
   9. Comply with IBC and local seismic requirements for all equipment and conduit pathways.

D. Cables, Wires, And Connectors:
   1. Cables:
      a. Cable and wire shall be new and unspliced.
      b. Splicing:
         1) Splicing of cables and conductors is expressly prohibited in any location other than equipment racks.
         2) Splicing of control and speaker level conductors shall be accomplished via punch block or terminal strip connections only.
      c. Additional cable length shall be provided at all connector locations. Duplex box, junction box, and floor box locations shall be installed with sufficient cable length behind cover plates to permit wiring maintenance and connector replacement in the future.
      d. When cable runs utilize vertical cable raceways located within walls, acoustic integrity of walls shall be maintained:
         1) Cables that pass-through cover plates of junction boxes and raceways, through slab-to-slab walls, and through conduit, lines shall be properly gasketed and sealed. Acoustic material shall be restored or replaced.
      e. Separation between system cables and other services shall be maximized to prevent and/or minimize potential for electromagnetic interference (EMI):
         1) Provide at least 12 inches (305 mm) separation from electrical lines whenever feasible.
         2) Where separation is unavoidable, distribution cables shall cross other services at right angles whenever practical to minimize EMI.
      f. Do not install signal cables on top of light fixtures, ceiling speakers, video projector lifts, projection screens, HVAC controls or sensing devices, fire safety and sprinkler system detection technology, or any other technology or mechanical equipment.
      g. Do not lay cables directly on top of T-bar grid ceiling tiles:
         1) Support cables installed outside of conduit at 4 feet (1.20 m) maximum intervals from building structure.

2) Do not utilize support wires from other trades or systems.

h. Install system cables shall not block access to other equipment or services, across removable service panels and/or in any other manner to prohibit routine maintenance of HVAC systems, fire safety equipment and building mechanical control systems.

i. Inter-rack cabling:
   1) Inter-rack cabling shall be neatly laced, dressed, strain relieved and adequately supported.
   2) Inter-rack cables shall be grouped according to signals being carried to reduce signal contamination. Separate groups shall be formed for following:
      (a) Power.
      (b) Control.
      (c) Video.
      (d) Audio cables carrying signals less than -20 dBM.
      (e) Audio cables carrying signals between -20 dBM and +20 dBM.
      (f) Audio cables carrying signals over +20 dBM.

j. Power cables, control cables, and high-level cables shall be run on left side of equipment racks as viewed from rear. All other cables shall be run on right side of all equipment racks as viewed from rear.

k. Cables, except video cables must be cut to electrical length, shall be cut to length dictated by cable run.

l. Terminal blocks, boards, strips or connectors, shall be furnished by installer for all cables which interface with racks, cabinets, consoles, or equipment modules. Affix terminal blocks, boards, strips or connectors to equipment racks using screws only. Double sided tape will not be accepted.

m. Shields for audio cables shall be grounded at input end only of various equipment items on system to prevent potential for ground loops.

n. Shields for microphone cables shall be grounded at both ends to allow Phantom Power to pass.

2. Wiring and Cabling:
   a. Comply with industry standard circuit polarity and loudspeaker wiring polarity. No cables shall be terminated with polarity reversal between connectors at either end.
   b. System wire, after being cut and stripped, shall have wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No bare wire ends shall be accepted.
   c. Do not place any wires and cables for this system in any conduit, raceway, wire way or cable tray that is used for mechanical systems of building.
   d. Route all cable and wiring within equipment racks, cabinets and millwork according to function, separating wires of different signal levels (microphone, line level, amplifier output, AC, control, etc.) by as much distance as possible. Neatly arrange, harness and bundle all cable with velcro straps.
   e. After completion of wiring and cable installation, all trough and box covers shall be notched out and grommeted for clearance of various cable bundles, (i.e., separate audio, video, and control). Panel covers shall be screwed back in place and all gaskets shall be restored or replaced.

3. Connectors:
   a. Provide connectors of type and quality as detailed in Contract Drawings and/or as required to meet minimum bandwidth requirements of equipment to which connectors are terminated. Overall quantity of connectors shall not be limited by quantities indicated in Contract Drawings and shall be provided as required.
   b. No connectors shall be installed in non-accessible locations or used for splicing cables. Connectors shall be new.
   c. Connectors shall incorporate strain relief mechanisms which firmly grip the jacket of connected cables.
   d. Connectors shall be properly polarized to prevent improper seating.

e. Connectors shall provide appropriate electrical characteristics for circuitry to which they are attached.
f. Exposed conductors inside of equipment racks shall be dressed with heavy duty neoprene heat-shrink tubing.
g. Heat-shrink type tubing shall be used to insulate and dress ends of all wire and cables including separate tube for ground or drain wire.
h. Solder connections shall be made with rosin-core solder. Temperature controlled soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns, gas or butane, or temperature unregulated irons shall be used on job site.
i. Mechanical connections shall be made with approved crimp lugs of correct size and type for connection. Wire nuts shall not be permitted except inside speaker enclosures. Each connector shall be attached with proper size controlled-duty-cycle ratcheting crimp tool approved by manufacturer.
j. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on job site. Presence of such tools on job site shall constitute evidence of mechanical connections made with unauthorized tools and shall provide sufficient grounds for rejection of all mechanical connections in system, and will be considered non-conforming work.

E. Mounting And Securing Equipment:
1. Equipment shall be firmly secured in place unless requirements of portability dictate otherwise.
2. Fastenings and supports shall be adequate to support their loads with safety factor of at least three (3) times weight of equipment being installed.
3. Any structural mounting that is not able to meet this requirement due to specific nature of equipment, manufacturer's requirements or limitations of facility, shall not be installed without prior approval of Engineer.
4. Install all boxes, equipment, hardware, and other materials plumb, level, and square.

F. Millwork:
1. Install technology equipment and support equipment in millwork in neat and cosmetically dressed out manner.
2. Install technology equipment and support equipment in podium, and other millwork in neat and cosmetically dressed out manner.
3. Saw cuts, holes and recesses into laminates and woodwork shall be straight.
4. Radius and circular cuts shall be consistent, and all uneven surfaces shall be corrected. This shall include use of moldings, grommets, bushings, laminates, and wood products as required to dress out installation of equipment.
5. Verify installation of equipment and panels in technology racks are completed by using matching screws, hardware and grommets.
6. Verify installation of equipment and panels in technology racks and podiums are completed by using matching screws, hardware and grommets.

G. Technology:
1. Provide sufficient ventilation for adequate cooling of equipment.
2. Install vent rack panels in unused spaces. Install vent panels at top and bottom and above each power amplifier.
3. Securely fasten equipment plumb and square in place. Where equipment is installed in rack cabinets, utilize all fastening holes and cove open spaces with perforated panels.
4. Securely fasten relays and small components. Do not use sticky-back tape for fasteners.
5. Install balancing transformer on each unbalanced input or output that connects to devices outside equipment cabinet, or that connects to balanced input or output within equipment cabinet.
6. Connect powered components to 120 VAC outlets on transient voltage surge suppressors. Do not connect to outlets on other components.

7. Leave sufficient service loops to uniform length on cables to allow operation of system with chassis outside cabinet.
8. Equipment shall be held firmly in place with proper types of mounting hardware as recommended and/or supplied by manufacturer:
    a. Mounting hardware provided with equipment shall be used when practical. This shall include, but not be limited to, front and rear rack rails, angle brackets and rack mount kits.
    b. Equipment shall be installed so as to provide reasonable safety to operator.

H. Install in accordance with manufacturer's instructions.

**3.04 SYSTEM SETUP**

A. Digital Video System Setup:
1. Pulpit HDMI and VGA Input (DTP T UWP 332D):
    a. Set Transmitter to Auto Switch between inputs, by shorting Contact Pins 1 and 2 to ground.

B. Rack Mounted DTP Receiver (DTP HDMI 330 RX):
1. Connect HDMI and Analog audio outputs to respective inputs on DTP switcher.

C. Video Switcher ‘VS’ Audio Setup:
1. Inputs:
    a. Video Input 2 must be set to Analog.
    b. Video Input 3 must be set to Multi-Ch Auto, system will automatically switch between analog and digital audio inputs when Input 3 is selected.
    c. Video Input 4 must be set to Multi-Ch Auto, system will automatically switch between analog and digital audio inputs when Input 4 is selected.
    d. Video Input 5 must be set for LPCM-2Ch Auto.
    e. Mic/Line Inputs 1 and 2 shall be muted.
2. Outputs:
    a. Input 1 and 6 must be set with preset which mutes analog audio outputs to Chapel when either input 1 or 6 is selected.
    b. All other inputs must be set up to unmute analog outputs.
    c. Input 5 must be configured to pass Left Program on Left Channel, Right Program on Right Channel.
    d. Variable analog output should be setup to pass ‘No Program’.
    e. Digital Outputs must be setup for ‘Stereo Program’.

D. Video Switcher ‘VS’ Video Setup:
1. Input Configuration:
    a. All inputs shall be labeled in software according to inputs connected to them.
    b. Input 1’s selected signal type shall match Camera’s Native Signal Output. IF no camera is installed, Signal type shall be set to composite.
    c. Input 2’s signal type shall be set to RGB.
    d. Aspect Ratio for Inputs 2 and 5 shall be set to follow, all others shall be set to fill.
    e. All Inputs shall be set to auto image, auto memory, HDCP authorized, and Film Detect.
2. Output Configuration:
    a. Set output Configuration to auto.
    b. Set Output Format for Auto for each output group.
    c. Set Transitions to ‘CUT’.
3. General Settings:
    a. Screen Saver shall be set to Blue with OSD Bug.
    b. Select display color when sending HDCP content on non-compliant device to Green.
    c. Set front Panel Lock out to Mode 2, allowing only input selection and volume controls.
    d. Set HDCP mode to Follow Input.

## 3.05 FIELD QUALITY CONTROL

A. Field Tests:
   1. Installer Testing:
      a. Upon completion of installation and before inspection by Audiovisual Consultant, test functions verifying following. Make necessary corrections:
         1) System is free from hum, noise, ghosting, loose parts and poor construction or soldering.
         2) Video signals shall be clear, sharp, noise-free picture with good chroma and undistorted, noise free audio.
         3) Audio to sound system is undistorted and noise free.
      b. Complete documentation required by Audiovisual Consultant and submit to consultant within five (5) days of Substantial Completion.

B. Field Inspections:
   1. Audiovisual Consultant Inspection:
      a. Coordinate final inspection schedule with Audiovisual Consultant two (2) weeks minimum before Consultant's final inspection.
      b. Have copy of Installer redlined documents sent to Audiovisual Consultant two (2) weeks minimum to before field inspection.
      c. Provide following test equipment in good working order:
         1) Digitally generated video test signal generator:
            (a) Generator shall provide minimum of but not be limited to industry standard test signals including color bar patterns, grey scale, alternating pixel, cross hatch and H-pattern.
            (b) Generator shall provide resolutions compatible with all specified video equipment.
            (c) Generator shall provide resolutions up to 4096 x 2160 at 60 Hz.
         2) Digital Volt-Ohmmeter.
         3) Necessary chargers, cable, test leads, adapters and other accessories for test equipment.
      d. Ensure Owner Furnished Display Devices such as projectors and video monitors are available and on site at time of inspections.
      e. Correct minor items so Audiovisual Consultant may certify satisfactory completion without return trip.

C. Non-Conforming Work:
   1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

D. Manufacturer Services:
   1. Provide services of factory authorized service representative to supervise field assembly and connection of components and pretesting, testing, and adjustment of system.

## 3.06 CLEANING

A. Waste Management:
   1. All work areas are to be kept clean, clear and free of debris at all times.
   2. Disposal of rubbish, debris, and packaging materials to Contractor provided Dumpster.
   3. Disposal of rubbish, debris, and packaging materials in proper manner.

**END OF SECTION**

**SECTION 27 4124**
**TELEVISION WALL MOUNTS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Furnish and install TV wall mount as described in Contract Documents.

### 1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

B. Section 06 1000 - Rough Carpentry for wall blocking and installation of television wall mounts.

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Provide Manufacturer's written installation instructions.

## PART 2 PRODUCTS

### 2.01 MANUFACTURED UNITS

A. TV Wall Mounts:
   1. Description:
      a. Large Flat Panel TV Swing Arm Wall Display Mount allowing for perfect display placement and ideal viewing from any angle and remains low-profile in home position.
   2. Design Criteria:
      a. Adjustable tilt mechanism.
      b. Mounting system secures flat panel to mount.
      c. Typical Screen Sizes: 75 inch (1 067 mm to 71 inch (1 803 mm).
      d. UL Listed.
      e. Weight Capacity: 200 lbs (90 kg).
   3. General:
      a. Lateral shift: 9 inch (230 mm).
      b. Manual Height Adjustment: 1 inch (25 mm).
      c. Maximum Extension: 37 inch (940 mm) extension.
      d. Minimum Depth: 3.4 inch (86.4 mm).
      e. Mounting Pattern Compatibility (Universal Versions): 200 x 200mm - 862 x 517mm.
      f. Orientation: landscape and portrait.
      g. Overall Dimensions 22 inches (559 mm) high x 39.5 inches (940 mm) wide x 3.4 inches (86 mm) deep.
      h. Tilt: +5 deg, -16 deg.
   4. Color: Black.
   5. Acceptable Products:
      a. PDRUB / PDR Series Large Flat Panel Swing Arm Wall Display Mount - 37 inch extension by Chief (Division of Milestone AV Technologies), Eden Prairie, Minnesota www.milestone.com.
      b. Equals as approved by Architect before bidding. See Section 01 6200.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verification of Conditions:
   1. Verify wall blocking in stud wall is in correct location for mounting TV Wall Mount before beginning installation.

## 3.02 INSTALLATION

A. Installing TV Wall Mount to Wall:
   1. Follow Manufacturer's written installation instructions for anchoring to wall.
   2. Install Mount so that top of TV is 3 inch (76 mm) minimum from ceiling.
   3. Install at locations shown on Contract Drawings.

**END OF SECTION**

**SECTION 28 1000**
**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 RELATED REQUIREMENTS

A. Section 08 4313 Aluminum-Framed Storefronts

B. Section 08 7100 - Door Hardware: Electrically operated door hardware, for interface with access control system.
   1. Includes door hardware with integral request to exit devices.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

### 1.03 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. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 294 - Access Control System Units Current Edition, Including All Revisions.

### 1.04 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.

B. Access Control Cloud Services:
   1. Subscription fees to be paid by Owner.
   2. Obtain Owner approval of subscription fees and terms of service prior to submittal.

C. Preinstallation Meetings:
   1. Conduct meeting with facility representative to review reader and equipment locations.
   2. Conduct meeting with facility representative and other related equipment manufacturers to discuss access control system interface requirements.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Action Submittals:
   1. Product Data:

2. Manufacturer's original catalog data and descriptive information on each piece of equipment to be used.
3. Manufacturer’s written installation instructions.
4. Manufacturer’s written maintenance and operation instructions.
5. Shop Drawings:
    a. Prepared by authorized factory representative and including:
        1) Single line diagram of actual system. Typical riser diagrams are not acceptable.
        2) Complete wiring diagrams.

C. Informational Submittals:
1. Certificates:
    a. Authorized Dealer Certificate and Certified Training Certificates of Installer(s).
2. Manufacturer Instruction:
    a. Instruction manual that explains operation of system.

D. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    a. Operations and Maintenance Data:
        1) Operation Manual
        2) Master Control Manual.
        3) Maintenance and operational instructions.
            (a) Battery replacement schedule.
            (b) Recommended backup procedures and schedule.
        4) Contact Information:
            (a) Provide name, address, and phone numbers including 24/7 contact if available.
    b. Warranty Documentation:
        1) Final, executed copies of Warranties on Master Control, Proximity Readers, and Electronic Locking Hardware.
2. Record Documentation:
    a. Manufacturers documentation:
        1) Manufacturer's literature or cut sheet for each item of the system.
        2) Manufacturer’s operating system backup.
        3) Two (2) keys to control box.

## 1.06 QUALITY ASSURANCE

A. Comply with the following:
1. NFPA 70.
2. NFPA 101 (Life Safety Code).
3. The requirements of the local authorities having jurisdiction.
4. Applicable TIA/EIA standards.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with access control systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.
1. Contract maintenance office located within 100 miles of project site.
2. Bonded and Licensed

C. Qualifications:
1. Factory-trained and certified.
2. Installer shall have performed at least three installations of similar size, scope, and complexity in each of the past two years and be approved by Access Control Manufacturer.

D. Comply with specifications and contract documents.

E. Maintenance Contractor Qualifications: Same entity as installer.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

## 1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty and Extended Warranties:
   1. Master Controller:
      a. Manufacturer’s Warranty against faulty workmanship and materials.
      b. Kindoo five (5) year warranty

C. Electronic Locking Hardware:
   1. Manufacturer’s Warranty on each component.

D. Proximity Reader:
   1. Manufacturer’s Lifetime Warranty on each unit.

E. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

F. Special Warranty:
   1. Distributor’s ninety (90) day no questions asked return of product guarantee.
   2. Distributor’s one (1) year guarantee covering installation:

# PART 2 PRODUCTS

## 2.01 SYSTEMS

A. Distributors:
   1. Approved Distributors. See Section 01 6200:
      a. Locktronics, 560 S 100 W, Suite 24, Provo, UT 84604
         1) Contact Information: Ryan Hales, 801-679-4827, ryan@locktronics.com

B. Description:
   1. Electronic door access system.

C. Design Criteria:
   1. Furnish and install complete electronic door access control system as described in contract documents. System shall include all necessary readers, controller, cables, connectors, power supplies, software, and accessories for a complete operational door access system with 2 door, 3 door, or 4 door option.

D. Materials:
   1. Approved Products. See Section 01 6200:
      a. KIN D Keyless Access Control System by Kindoo LLP

## 2.02 ACCESSORIES

A. Cable:
   1. Reader-22/6 Cable-Stranded / Shielded as required by Manufacturer.
   2. Strikes-18/4 Cable-Stranded / Shielded as required by Manufacturer

B. Readers:
   1. HID multiclass SE or newer:
   2. Multi capability including encrypted credentials.
   3. Bluetooth LE capabilities

C. Credentials:
   1. HID iClassSE or newer technology with encrypted/SIO credentials:
   2. New installations shall use encrypted credentials.
   3. Seos cards which cannot be punched.

## 2.03 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. Access Control Points:
   1. See article "ACCESS CONTROL POINT PERIPHERALS" below for device descriptions.

C. Interface with Other Systems:
   1. Provide products compatible with other systems requiring interface with access control system.

D. 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.

## 2.04 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.

## 2.05 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. Provide readers compatible with credentials to be used

D. Provide credentials.

E. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 7100.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verification Of Conditions:
   1. Examine substrate and verify it suitable for installation of system:
      a. Notify Architect of unsuitable conditions in writing.
      b. Commencement of Work by installer is considered acceptance of substrate.

## 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. Provide grounding and bonding in accordance with Section 26 0526.

D. Identify system wiring and components in accordance with Section 26 0553.

E. Interface With Other Work:
   1. Coordinate with Division 26 for location of duplex for master controller and pull string inside storefront door mullion where electric strike and pull string to proximity reader.
   2. Coordinate with Division 08 storefront entrances.

F. General:
   1. Install Access Door System as per Manufacturer’s written instructions.

## 3.03 INSTALLERS

A. Approved installers
   1. As approved by Kindoo LLP

## 3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Program system parameters according to requirements of Owner.

D. Test for proper interface with other systems.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

F. Field Tests:
   1. Conduct test (at Closeout) of system in presence of Owner and show system to be free of defective workmanship and materials.

G. Non-Conforming Work:
   1. Replace system components that fail to perform as designed.
   2. Correct all work not in compliance to Contract Documents at no additional cost to Owner

**3.05 CLEANING**

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

B. Waste Management:
   1. Perform daily clean-up to collect wrappings, empty containers, paper, and other debris from project site.
   2. Upon completion, debris must be disposed of in legally acceptable manner

**3.06 CLOSEOUT ACTIVITIES**

A. Instruction Of Owner:
   1. Perform up to three (3) hour maximum training session for Owner's Representative(s) demonstrating operation and maintenance of completed systems.
   2. System operational instructions.
   3. System maintenance procedures.
   4. Backup procedures and schedule.
   5. Battery replacement schedule.

**3.07 PROTECTION**

A. Protect installed system components from subsequent construction operations.

**END OF SECTION 28 1000**

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**SECTION 28 4600**
**FIRE DETECTION AND ALARM**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

### 1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

C. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

D. Section 281600 - Intrusion Detection System - Honeywell.

### 1.03 ICC (IFC) 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 - 2010 ADA Standards for Accessible Design; 2010.

C. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 1480 - Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

I. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

J. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

K. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

L. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

M. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
   12. Certification by Contractor that the system design complies with Contract Documents.

D. Evidence of installer qualifications.

E. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

F. Operating and Maintenance Data:
   1. Complete set of specified design documents, as approved by authority having jurisdiction.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.
   7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

G. Project Record Documents:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

H. Closeout Documents:
   1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.

2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

### 1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level II, III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### 1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
   1. Honeywell Security & Fire Solutions/Fire-Lite: www.firelite.com/#sle.
   2. Honeywell Security & Fire Solutions/Silent Knight: www.silentknight.com/#sle.
   3. Potter Electric Signal Company: www.pottersignal.com/#sle.
   4. Mircom Group - Secutron
   5. Autocall by Johnson Controls: www.jci.com.
   6. Provide control units made by the same manufacturer.
   7. Kidde: www.kidde.com

B. Initiating Devices and Notification Appliances:
   1. Same manufacturer as control units.

C. Substitutions: See Section 01 6000 - Product Requirements.
   1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.
   2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

### 2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in Contract Documents or not.

2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    a. ADA Standards.
    b. The requirements of the local authority having jurisdiction.
    c. Applicable local codes.
    d. Contract Documents (drawings and specifications).
    e. IFC
    f. NFPA 101.
    g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.
5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
6. Program notification zones and voice messages as directed by Owner.
7. Master Control Unit (Panel): New, located at location indicated on the plans..

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By remote supervising station operated by owner.
2. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
    a. Owner provided cellular communicator

C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 10 percent spare capacity.
2. Notification Appliance Circuits: Minimum 10 percent spare capacity.
3. Speaker Amplifiers: Minimum 10 percent spare capacity.
4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

## 2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Trouble: Provide trouble signals in accordance with NFPA 72 for the following:
1. Primary power failure
2. Opens or short circuits on indicating circuits.
3. Disarrangements in system wiring.
4. Control panel circuit board removal.
5. Ground faults.

B. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
2. Serving area smoke detector tied to range shunt-trip.
3. Low temperature switches.
4. Carbon Monoxide detector

C. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow. The following message shall sound on the voice evacuation system: "There has been a report of fire in the building. Please evacuate the building until it has been cleared by emergency responders."
2. Duct smoke detectors. Turn off
3. Area smoke detectors. The following message shall sound on the voice evacuation system: "There has been a report of fire in the building. Please evacuate the building until it has been cleared by emergency responders."
4. Heat detectors. The following message shall sound on the voice evacuation system: "There has been a report of fire in the building. Please evacuate the building until it has been cleared by emergency responders."
5. Manual stations. The following message shall sound on the voice evacuation system: "There has been a report of fire in the building. Please evacuate the building until it has been cleared by emergency responders."
6. Serving area heat detector. The following message shall sound on the voice evacuation system: "There has been a report of fire in the building. Please evacuate the building until it has been cleared by emergency responders."
7. Carbon Monoxide detector. The following message shall sound on the voice evacuation system: "There has been a report of carbon monoxide in the building. Please evacuate the building until it has been cleared by emergency responders."

D. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
2. Carbon Monoxide Detectors: Turn off all fuel burning appliances

**2.04 COMPONENTS**

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
1. Solid-state design with flush or semi-flush mounting.
2. Control functions shall be behind locked door with annunciating devices visible through door. Single key shall operate all keyed functions in system. Provide three keys.
3. 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 shall be powered by 24-V dc source.
4. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
5. 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.
   a. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
   b. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
6. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.
   a. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.

1) Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
2) Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.

b. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
c. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

C. Remote Annunciators: 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.

D. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
2. Manual Pull Stations:
a. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
b. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
c. Station Reset: Key- or wrench-operated switch.
d. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation. STI-1100.
3. Smoke Detectors:
a. Photoelectric Smoke Detectors:
1) Mounting: Twist-lock base.
2) 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.
3) 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.
b. 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.
3) Each sensor shall have multiple levels of detection sensitivity.
4) Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5) Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

4. Heat Detectors:
    a. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
        1) Mounting: Twist-lock base interchangeable with smoke-detector bases.
5. Low Building Temperature Device:
    a. Setpoint Temperature Range: 35°F to 100°F. Set for contact closure at 35°F.
    b. Output: SPDT.
    c. Products:
        1) Honeywell T631A1006.
6. Carbon monoxide (CO) detection:
    a. Carbon monoxide detectors shall meet UL 217, UL 2075 and UL 2034.
    b. Detectors shall be addressable
    c. Combination heat/CO sensors are acceptable
    d. Combination smoke/CO sensors are acceptable
    e. Provide devices compatible with the control unit.
    f. Device shall be provided with a from C relay.

E. Notification Appliances:
1. Voice/Tone Notification Appliances:
    a. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
    b. High-Range Units: Rated 2 to 15 W.
    c. Low-Range Units: Rated 1 to 2 W.
    d. Mounting: Flush.
    e. Matching Transformers: Tap range matched to acoustical environment of speaker location.
2. Visible Notification Appliances: LED strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
    a. Rated Light Output:
        1) 15/30/75/110 cd, selectable in the field.
    b. Mounting: Wall mounted unless otherwise indicated.
    c. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
    d. Flashing shall be in a temporal pattern, synchronized with other units.
    e. Strobe Leads: Factory connected to screw terminals.
    f. Mounting Faceplate: Factory finished, white.
3. Device Guards: Welded wire mesh of size and shape for the notification appliance requiring protection.
    a. Factory fabricated and furnished by manufacturer of device.

F. Digital Alarm Communicator Transmitter
1. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report communication service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

G. Circuit Conductors: Copper; provide 200 feet extra; color code and label.

H. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
2. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

I. Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type

J. Documentation cabinet: Steel with baked enamel finish, size appropriate to contain all necessary documentation. cabinet shall be lockable and accessible by authorized personnel only. Labeled System Record Documents.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

C. Smoke- or Heat-Detector Spacing:
1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Smooth ceiling spacing shall not exceed 30 feet (9 m).
3. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and IMC. Install sampling tubes so they extend the full width of duct.

E. Carbon Monoxide Detectors: Install 80" Above finished floor. Ceiling mounted detectors shall be listed for the application. Space devices per NFPA 72 and manufacturer's recommendations.

F. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

H. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

I. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

J. Documentation cabinet:
1. Install at fire alarm panel or another approved location at the protected premises.
2. All record documentation shall be stored in the documentation cabinet.
3. No record documentation shall be stored in the control unit.
4. When not at control unit indicate location of documentation cabinet at the control unit.
5. Emergency communication system and fire alarm system record documentation shall be permitted to be maintained together in the same cabinet.

K. Church Asset Tagging:
1. Request asset tags for the fire alarm and carbon monoxide detection systems from the project or facility manager.
2. Install the Church tag provided to the front of the fire alarm and carbon monoxide detections systems.

### 3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

**3.03 FIELD QUALITY CONTROL**

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Tests and Inspections:
   1. Visual Inspection: Conduct visual inspection prior to testing.
      a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
   2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
   3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
   4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
   5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

**3.04 CLOSEOUT**

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.

4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

**END OF SECTION 28 4600**

**SECTION 31 0500**
**COMMON EARTHWORK REQUIREMENTS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. General procedures and requirements for earthwork.

B. Verification of conditions.

C. Preparation.

D. Repair and restoration.

E. Field quality control.

### 1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.

B. Section 32 9001 - Common Planting Requirements:
   1. Pre-installation conference held jointly with other landscape related sections.

### 1.03 REFERENCES

A. Definitions:
   1. Aggregate Base: Layer of granular material immediately below concrete and asphalt paving or miscellaneous site concrete (sidewalks, curbs, etc) and below interior concrete slabs on grade.
   2. Base: See Aggregate Base.
   3. Building Grading: Sloping of grounds immediately adjacent to building. Proper grading causes water to flow away from a structure. Grading can be accomplished either with machinery or by hand.
   4. Compacted Fill: Placement of soils on building site placed and compacted per Contract Documents.
   5. Excavation: Removal of soil from project site or cavity formed by cutting, digging or scooping on project site.
   6. Fine Grading (FG): Preparation of subgrade preceding placement of surfacing materials (any aggregate base and topsoil) for contour of building site required. Fine Grading is conducted to ensure that earth forms and surfaces have been properly shaped and subgrade has been brought to correct elevations. It is performed after rough grading and placement of any complicated fill but before placement of aggregate base or topsoil.
   7. Finish Grading: Completed surface elevation of landscaping areas for seeding, sodding and planting on building site.
   8. Natural Grade: Undisturbed natural surface of ground.
   9. Rough Grading (RG): Grading, leveling, moving, removal, and placement of existing or imported soil to its generally required location and elevation. Cut and fill is part of rough grading.
   10. Subgrade (definition varies depending upon stage of construction and context of work being performed):
      a. Prepared natural soils on which fill, aggregate base, or topsoil is placed OR
      b. Prepared soils immediately beneath paving, sidewalks or topsoil.
   11. Topsoil Placement and Grading: Topsoil placement and finish grading work required to prepare site for installation of landscaping.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Consulting Engineers (Civil, Structural, Geotechnical) are to incorporate the requirements of the Geotechnical Evaluation Report for site specific requirements into all specification sections found in Division 31 and 32 as part of the design process.

B. Preinstallation Meeting: Schedule meeting after completion of site clearing but no less than one week before beginning grading work for all affected installers.
   1. Include a review of:
      a. Geotechnical Evaluation Report
      b. Earthwork schedule.
         1) Site clearing.
         2) Earth moving
      c. Field tests and inspection requirements.
      d. Review Landscape Grading requirements.
      e. Termite control application requirements.
   2. Include a review of items that occur before pre-installation conference for landscape sections:
      a. Clearing and grubbing requirements.
      b. Topsoil stripping and stockpiling requirements.
      c. Landscape grading requirements.
      d. Landscape finish grade tolerance requirements.
      e. Landscape and plant tolerances.
      f. Surface preparation of landscape and planting areas.

C. Pre-installation meeting for landscape sections as specification in Section 32 9001:
   1. Schedule meeting after completion of Fine Grading, but one week minimum before beginning landscape work and held jointly with following sections:
      a. Section 32 8423 - Underground Sprinklers: No Controllers.
      b. Section 32 9120 - Topsoil and Placement.
      c. Section 32 9122 - Topsoil Grading.
      d. Section 32 9219 - Seeding
      e. Section 32 9223 - Sodding.
      f. Section 32 9300 - Plants.
   2. Post-installation meeting: Review that following landscape items have been installed correctly:
      a. Topsoil placement.
      b. Topsoil surface preparation.
      c. Topsoil depth.
      d. Landscape finish grade tolerances.
      e. Surface preparation of landscape and planting areas.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verification of Conditions:
   1. Contact Underground Service Alert to arrange for utility location services forty-eight (48) hours, minimum, before performing any work on site.
   2. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.
   3. Perform investigative excavating ten (10) days, minimum, in advance of performing any excavation or underground work.
   4. Notify Architect by phone or fax within twenty-four (24) hours upon discovery of conflicts or problems with existing facilities. Follow telephone or fax notification with letter and diagrams indicating conflict or problem with sufficient measurements and details to evaluate problem.

### 3.02 PREPARATION

A. Protection:

1. Spillage:
    a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
    b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.
2. Dust Control:
    a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
    b. Correct or repair damage caused by dust.
3. Existing Plants And Features:
    a. Do not damage tops, trunks, and roots of existing trees and shrubs on site that are intended to remain.
    b. Do not use heavy equipment within branch spread.
    c. Interfering branches may be removed only with permission of Architect.
    d. Do not damage other plants and features that are to remain.

**3.03 REPAIR / RESTORATION**

A. Adjust existing covers, boxes, and vaults to grade.

B. Replace broken or damaged covers, boxes, and vaults.

C. Independently confirm size, location, and number of covers, boxes, and vaults that require adjustment.

**3.04 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Owner is responsible for Quality Assurance: Quality Assurance performed by Owner will be used to validate Quality Control by Contractor. Refer to Section 31 2323 Part 3 for subgrade, fill and aggregate base testing and inspection requirements.
    1. Quality Control is sole responsibility of Contractor.
    2. Testing and inspection of earthwork operations is required.
    3. Notify Architect if weather, scheduling, or any other circumstance has interrupted work, twenty-four (24) hours minimum, before intended resumption of work.

C. Non-Conforming Work:
    1. If specified protection precautions are not taken or corrections and repairs not made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of The Work.

**END OF SECTION**

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**SECTION 31 1000**
**SITE CLEARING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. This Section includes the following:
   1. Protecting existing trees, shrubs, groundcovers, plants and grass to remain.
   2. Clearing and grubbing.
   3. Stripping and stockpiling topsoil.
   4. Removing above- and below-grade site improvements.
   5. Disconnecting and capping or sealing site utilities.
   6. Temporary erosion and sedimentation control measures.

### 1.02 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

### 1.03 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

## PART 2 PRODUCTS

### 2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Sediment and Erosion Control Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.03 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

### 3.04 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

   1. Arrange with utility companies to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

**3.05 CLEARING AND GRUBBING**

A. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground. Structural fill material to be placed at a minimum of 95 percent of the maximum dry density of the material.

**3.06 TOPSOIL STRIPPING**

A. Remove sod and grass before stripping topsoil.
B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

**3.07 SITE IMPROVEMENTS**

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

**3.08 DISPOSAL**

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
   1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

**END OF SECTION**

**SECTION 31 1413**
**TOPSOIL STRIPPING AND STOCKPILING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Strip and stockpile acceptable topsoil as described in Contract Documents.

B. Related Requirements:
   1. Section 31 0500: 'Common Earthwork Requirements':
      a. General procedures and requirements for earthwork.
      b. Pre-installation conference held jointly with other common earthwork related sections.
      c. Pre-installation conference held jointly with other landscape related sections.
   2. Section 31 1000: 'Site Clearing'.
   3. Section 31 2200: 'Grading'.
   4. Section 31 2316: 'Excavation and Trenching'.
   5. Section 32 9001: 'Common Planting Requirements'.
   6. Section 32 9120: 'Topsoil And Placement'.
   7. Section 32 9122: 'Topsoil Grading'.

### 1.02 REFERENCES

A. Definitions:
   1. Existing topsoil: Defined as total amount of soil stripped and stored for reuse, less vegetation layer stripped and disposed of as specified in Paragraphs below.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conferences as specified in Section 31 0500.

## PART 2 PRODUCTS: NOT USED

## PART 3 EXECUTION

### 3.01 PERFORMANCE

A. Strip existing vegetation layer (___) inches (mm) deep minimum from areas of site to receive buildings, landscaping, and paving and remove from site before stripping topsoil for storage and reuse.

B. After stripping vegetation layer, strip existing topsoil additional inches (mm) deep minimum from areas of site to receive buildings and paving and store on site for later use.
   1. Existing topsoil is property of Contractor with restriction that topsoil is to be used first for Project landscape topsoil requirements and second for non-structural fill and backfill.
   2. After Project fill, backfill, and landscape topsoil requirements are satisfied, remove excess existing topsoil from site. Do not remove existing topsoil from site without Architect's written approval.

C. Screen existing topsoil to meet standards established as specified in Section 32 9120 'Topsoil And Placement'.

**END OF SECTION**

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**SECTION 31 2000**
**EARTH MOVING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. This Section includes the following:
   1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for slabs-on-grade.
   4. Base course for asphalt paving and concrete pavement and walks.
   5. Excavating and backfilling for utility trenches.

B. Related Sections:
   1. Governing City Standards and Specifications for improvements in public Right-of-Way.

### 1.02 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving and concrete pavement and walks.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Course placed between the subgrade and base course.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

### 1.03 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

## PART 2 PRODUCTS

### 2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 and A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 1-1/2-inch sieve and 7-11 percent passing a No. 200 sieve.

The road base must conform to applicable section s of the current Utah Department of Transportation (UDOT) Standard Specifications. All asphalt material and paving operations should meet applicable specifications of the Asphalt Institute and UDOT. A GSH technician shall observe placement and perform density testing of the road base course material and asphalt. Please note that the 3rd column of Table 2 of Section 02721 “Job Mix Gradation Tolerance” does not apply to road base utilized on this project and all road base must meet the requirements of the 2nd column of Table 2 of Section 02721 “Job Mix Gradation Target Blent” without any additional tolerances. The aggregate gradation limits presented on Table 2 of Section 02721, Untreated Base Course (UTBC) (road base) of UDOT 2025 standard Specification for Road and Bridge Construction are tabulated below:

| Gradation Limits | |
|---|---|
| **Sieve Size** | **Job Mix Gradation Target Blend** |
| 1 1/2 inch | 100 |
| 1 inch | 90-100 |
| 3/4 inch | 70-85 |
| 1/2 inch | 65-80 |
| 3/8 inch | 55-75 |
| No. 4 | 40-65 |
| No. 16 | 25-40 |
| No. 200 | 7-11 |

Percent passing based on total aggregate (dry weight), and fine and coarse aggregate having approximately the same bulk specific gravities.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing." during earthwork operations.

**3.02 EXCAVATION**

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

**3.03 EXCAVATION FOR STRUCTURES**

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

**3.04 EXCAVATION FOR WALKS AND PAVEMENTS**

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

**3.05 EXCAVATION FOR UTILITY TRENCHES**

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
   1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

**3.06 SUBGRADE INSPECTION**

A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

**3.07 UNAUTHORIZED EXCAVATION**

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

**3.08 STORAGE OF SOIL MATERIALS**

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

**3.09 UTILITY TRENCH BACKFILL**

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

**3.010 SOIL FILL**

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

**3.011 SOIL MOISTURE CONTROL**

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

**3.012 COMPACTION OF SOIL BACKFILLS AND FILLS**

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Under structures, buildings, slabs, steps, and pavements, cut to undisturbed natural soil below topsoil, unsuitable fill and other unsuitable materials and compact each layer of backfill or fill to at least 96 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
   3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of backfill to at least 96 percent.

**3.013 GRADING**

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

**3.014 SUBBASE AND BASE COURSES**

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
   1. Shape subbase and base course to required crown elevations and cross-slope grades.
   2. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 96 percent of maximum dry unit weight according to ASTM D 1557.

**3.015 DRAINAGE COURSE**

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   2. Compact each layer of drainage course to required cross sections and thicknesses to not less than **95** percent of maximum dry unit weight according to ASTM D 698.

**3.016 FIELD QUALITY CONTROL**

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.
E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

**3.017 PROTECTION**

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
    1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

**3.018 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

**END OF SECTION**

**SECTION 31 2200**
**GRADING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading .

C. Fine grading

### 1.02 RELATED REQUIREMENTS

A. Section 31 0500 - Common Earthwork Requirements.

B. Section 31 1000 - Site Clearing.

C. Section 31 2316 - Excavation and Trenching.

D. Section 31 2323 - Fill and Aggregate Base: Filling and compaction of fill and aggregate base materials.

E. Section 32 1216 - Asphalt Paving

F. Section 32 1216 - Concrete Paving

G. Section 32 9120 - Topsoil and Placement

H. Section 32 9122 - Topsoil Grading

I. Section 32 9219 - Seeding.

J. Section 32 9223 - Sodding.

K. Section 32 9300 - Plants.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Per Section 31 0500 - Common Earthwork Requirements:.
   1. Identify benchmark for establishing grades.
   2. Examine site to pre-plan procedures for cuts, fill placements, and other necessary work.

### 1.04 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

### 1.05 QUALITY ASSURANCE

A. Owner is responsible for Quality Assurance: Quality Assurance performed by Owner will be used to validate Quality Control performed by Contractor.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Topsoil: See Section 32 9121.

B. Other Fill and Aggregate Base Materials: See Section 31 2323.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Verify the absence of standing or ponding water.

C. Do not commence work of this Section until topsoil has been prepared, according to 32 9121.

### 3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

**3.03 SOIL REMOVAL AND STOCKPILING**

A. Stockpile excavated topsoil on site.

B. Stockpile topsoil to be re-used on site; remove remainder from site.

C. Remove excavated topsoil from site.

D. Stockpile excavated subsoil on site.

E. Stockpile subsoil to be re-used on site; remove remainder from site.

F. Remove excavated subsoil from site.

G. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

**3.04 ROUGH GRADING**

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 2323 for filling procedures.

G. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

H. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

**3.05 FINE GRADING**

A. Preparation:
   1. Protection Of In-Place Conditions: Protect utilities and site elements from damage.
   2. Landscaping and Planting Areas:
      a. Before grading, dig out weeds from planting areas by their roots and remove from site. Remove rocks larger than 1-1/2 inches in size and foreign matter such as building rubble, wire, cans, sticks, concrete, etc.
      b. Remove imported paving base material present in planting areas down to natural subgrade or other material acceptable to Architect.
   3. Paving:
      a. Survey and stake parking surfaces to show grading required by Contract Documents.
      b. Subgrade (material immediately below aggregate base):
         1) Compact subgrade as specified in Section 31 2213 (natural soils) and Section 31 2323 (fill).
         2) Fine grade parking surface area to grades required by Contract Documents.
         3) Subgrade to be constructed smooth and even.

**3.06 TOLERANCES**

A. Subgrade beneath compacted fill, aggregate base or topsoil shall be constructed smooth and even.

B. Rough Grading:
   1. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.
   2. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

C. Fine Grading
   1. Subgrade (material immediately below aggregate base, natural soils or fill):
      a. 0.00 inches high.
      b. Measure using string line from curb to curb, gutter, flat drainage structure, or grade break.
   2. Maximum variation from required grades shall be 1/10 of one foot (28 mm).
   3. Aggregate Base:
      a. Under Interior Concrete Slabs on Grade:
         1) Place 4 inches minimum of aggregate base under vapor retarder, level, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.
      b. Under Equipment Pad Areas:
         1) Place 4 inches minimum of aggregate base, level, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.
      c. Under Driveways And Parking Areas:
         1) Use 6 inches minimum aggregate base under paving for meetinghouse and CES projects, unless noted otherwise in Contract Drawings, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.
         2) Priming: Prime aggregate base with application of 0.2 to 0.5 gallons (2 to 5 liters) of asphalt cement primer per square yard (meter) if pavement will be laid more than three days after compaction of aggregate base, or if precipitation is anticipated between completion of compaction of aggregate base and laying of asphalt paving.
         3) Recompact unprimed aggregate base if it receives precipitation before pavement is laid.
         4) Remove or repair improperly prepared areas as directed by Architect.
         5) Measure using string line from curb to curb, gutter, flat drainage structure, or grade break.
      d. Under Miscellaneous Concrete Site Elements (sidewalks, curbs, gutters, not mow strips) And Outside Face of Foundation Walls:
         1) Four inches minimum of aggregate base. Level, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.
      e. Under Exterior Mow Strips:
         1) 6 inches of 3/4 inch gravel.
   4. Landscaping and Planting Tolerances:
      a. Maximum variation from required grades shall be 1/10 of one foot (28 mm).
      b. To allow for final finish grades as specified in Section 32 9121 of planting areas, fine grade elevations before placing topsoil and mulch are:
         1) Sod Areas: 7 inches (175 mm) below top of walk or curb.
         2) Seeded Areas: 6 inches (150 mm) below top of walk or curb.
         3) Ground Cover Areas: 7 inches (180 mm) below top of walk or curb.
         4) Tree And Shrub Areas: 4 inches (100 mm) below top of walk or curb.

D. Slope grade away from building as specified in Section 31 2323.

**3.07 REPAIR AND RESTORATION**

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

### 3.08 FIELD QUALITY CONTROL

A. See Section 31 2323 for compaction density testing.

### 3.09 CLEANING

A. Leave site clean and raked, ready to receive landscaping.

**END OF SECTION**

# SECTION 31 2316
# EXCAVATION AND TRENCHING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

### 1.02 RELATED REQUIREMENTS

A. Section 31 0500 - Common Earthwork Requirements.

B. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

C. Section 31 2200 - Grading: Soil removal from surface of site.

D. Section 31 2200 - Grading: Grading.

E. Section 31 2323 - Fill and Aggregate Base: Fill materials, backfilling, and compacting.

F. Section 33 3113 - Site Sanitary Sewerage Gravity Piping

G. Performance of excavating inside and outside of building required for electrical and mechanical work is responsibility of respective Section doing work unless arranged differently by Contractor.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Per Section 31 0500 - Common Earthwork Requirements and:
   1. Review protection of existing utilities requirements.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verification Of Conditions:
   1. Carefully examine site and available information to determine type soil to be encountered.
   2. Discuss problems with Architect before proceeding with work.

### 3.02 PREPARATION

A. Locate, identify, and protect utilities that remain and protect from damage.

B. Contact Architect immediately upon discovery of undocumented utilities.

### 3.03 PERFORMANCE

A. Interface With Other Work:
   1. See Section 31 2323 for subgrade preparation at general excavations.

B. Excavate to accommodate new structures and construction operations.
   1. Excavate to the specified elevations.
   2. Excavate to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work.
   3. Cut utility trenches wide enough to allow inspection of installed utilities.
   4. Hand trim excavations. Remove loose matter.

C. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

F. Utility Trenches:

1. Unless otherwise indicated, excavation shall be open cut. Short sections of trench may be tunneled if pipe or duct can be safely and properly installed and backfill can be properly tamped in tunnel sections and if approved by Architect.
2. Excavate to proper alignment, depth, and grade. Excavate to sufficient width to allow adequate space for proper installation and inspection of utility piping.
3. If trenches are excavated deeper than required, backfill until trench bottom is proper depth with properly compacted native material.
4. Pipe 4 inches in Diameter or Larger:
    a. Grade bottom of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its length.
    b. Except where rock is encountered, take care not to excavate below depths indicated.
        1) Where rock excavations are required, excavate rock with minimum over-depth of 4 inches below required trench depths.
        2) Backfill over-depths in rock excavation and unauthorized over-depths with loose, granular, moist earth, thoroughly compacted.
    c. Whenever wet or unstable soil incapable of properly supporting pipe, as determined by Architect, occurs in bottom of trench, remove soil to depth required and backfill trench to proper grade with coarse sand, fine grave, or other suitable material acceptable to Architect.

**3.04 REPAIR**

A. Repair damage to other portions of the Work resulting from wok of this Section at no additional cost to Owner. Arrange for damage to be repaired by original installer.

B. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

**3.05 CLEANING**

A. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 2200.

B. Remove excavated material that is unsuitable for re-use from site.

C. Remove excess excavated material from site.

**END OF SECTION**

**SECTION 31 2323**
**FILL AND AGGREGATE BASE**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, and utilities within the building.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

D. Lightweight (Flowable) concrete fill (option for backfilling of piping systems and other utilities)

E. Aggregate Base:

### 1.02 RELATED REQUIREMENTS

A. Section 31 0519 - Geosynthetics for Earthwork.

B. Section 31 0500 - Common Earthwork Requirements

C. Section 31 1000 - Site Clearing

D. Section 31 2200 - Grading: Removal and handling of soil to be re-used.

E. Section 31 2200 - Grading: Site grading.

F. Section 31 2316 - Excavation and Trenching: Removal and handling of soil to be re-used.

G. Section 31 3116 - Termite Control

H. Section 32 1216 - Asphalt Paving

I. Section 32 1213 - Concrete Paving

J. Section 33 4100 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

K. Division 32 - Exterior Improvements

### 1.03 REFERENCE STANDARDS

A. ASTM C150/C150M - Standard Specification for Portland Cement 2022.

B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

C. ASTM C796/C796M - Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam 2019.

D. ASTM D1883 - Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils 2016.

E. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2017, with Editorial Revision (2020).

F. ASTM D6817/D6817M - Standard Specification for Rigid Cellular Polystyrene Geofoam 2017 (Reapproved 2021).

G. ASTM D7557/D7557M - Standard Practice for Sampling of Expanded Polystyrene Geofoam Specimens 2009 (Reapproved 2021).

H. 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 2018a.

### 1.04 DEFINITIONS

A. Lightweight (Flowable) Concrete Fill::
   1. Self-leveling and self-compacting, cementitious material.
   2. Unconfined compressive strength of less than 150 psi.

3. Cementitious slurry consisting of mixture of fine aggregate of filler, water and cementitious materials, which is used as fill or backfill in lieu of compacted earth. This material is capable of filling all voids in irregular excavations and hard to reach places (such as under undercuts of existing slabs), is self-leveling, and hardens in a matter of a few hours without need for compacting in layers. Lightweight (Flowable) concrete fill is sometimes referred to as excavatable flowable fill, controlled density fill , controlled low strength material, lean concrete slurry, and unshrinkable fill. Flowable fill is not concreter nor used to replace concrete. it is intended to contain low cementitious content for reduced strength development.

B. Reclaimed Asphalt Pavement (RAP): Existing asphalt mixture that has been pulverized, usually by milling, and is used like an aggregate in recycling of asphalt pavements.

## 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Mix design for Lightweight (Flowable) Concrete Fill.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

D. Compaction Density Test Reports.

E. Lightweight (Flowable) Concrete Fill Test Reports.

F. Testing Agency Qualification Statement.

## 1.06 ADMINISTRATIVE REQUIREMENTS

A. Participate in pre-installation meeting as specified in Section 31 0500.

## 1.07 QUALITY ASSURANCE

A. Testing and Inspection:
   1. Owner will provide Testing and Inspection for fill and aggregate base:
      a. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
   2. Owner will employ testing agencies to perform testing and inspection for aggregate base as specified in Field Quality Control in Part 3 of this specification.
      a. Owner’s employment of an independent Testing Agency does not relieve Contractor of Contractor’s obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.

B. Designer Qualifications: Perform design of structural fill under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Scheduling:
   1. Allow special inspector to review all subgrades and excavations to determine if site has been prepared in accordance with geotechnical evaluation report prior to placing any fill or aggregate base (or concrete).
   2. Notify Testing Agency and Architect seventy-two (72) hours minimum before installation of fill or aggregate base to perform proctor and plasticity index tests on proposed fill, aggregate base or subgrade.
   3. Notify Testing Agency and Architect twenty-four (24) hours minimum before installation of fill or aggregate base to allow inspection.
   4. Allow Inspection and Testing Agency to inspect and test subgrades and each fill and aggregate base layer. Proceed with subsequent earthwork only after inspections and test results for prior compacted work comply with requirements.
   5. Interior slab-on-grade concrete:

a. Notify Architect twenty-four (24) hours minimum before installation of concrete to allow inspection of vapor retarder installation.
b. Notify Testing Agency and Architect twenty-four (24) hours minimum before installation of interior concrete slabs to allow inspection of aggregate base.
c. Allow special inspector to review all subgrades and excavations to determine if building pad has been prepared in accordance with geotechnical report prior to placing any aggregate base.

6. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing concrete for exterior site work concrete (sidewalks, curbs, gutters), footings, foundation walls, and building slabs to allow inspection of aggregate base.
7. Paving:
   a. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing aggregate base to allow inspection of aggregate base.

## PART 2 PRODUCTS

### 2.01 FILL MATERIALS

A. General Fill - Fill Type [____]: Subsoil excavated on-site.
   1. Graded.
   2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   3. Complying with ASTM D2487 Group Symbol CL.

B. Fill:
   1. Well graded material conforming to ASTM D2487 free from debris, organic material, frozen materials, brick, lime, concrete, and other material which would prevent adequate performance of backfill.
      a. Under Building Footprint And Paved Areas: Fill shall comply with soil classification groups GW, CL, GP, GM, SW, SP, or SM. Fill may not contain stones over 6 inches diameter and ninety-five (95) percent minimum of fill shall be smaller than 1-1/2 inch in any direction.
      b. Under Landscaped Areas:
         1) Fill more than 36 inches below finish grade shall comply with soil classification groups GW, CL, GP, GM, SW, SP, or SM. Fill may not contain stones over 6 inches (150 mm) diameter and ninety (90) percent minimum of fill shall be smaller than 1-1/2 inch in any direction.
         2) Fill less than 36 inches below finish grade shall comply with soil classification groups SW, SP, SM, or SC. Fill may not contain stones larger than 1-1/2 inches in any direction and ninety (90) percent minimum of fill shall be smaller than 3/8 inch in any direction.

C. Engineered Fill:
   1. Structural Fill - Fill Type [____]: Subsoil excavated on-site.
      a. Graded.
      b. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
      c. Complying with ASTM D2487 Group Symbol CL.

D. Lightweight (Flowable) Concrete Fill:
   1. Finished Properties, Class II Engineered Fill:
      a. Cast Density, Maximum: 30 pounds per cubic foot.
      b. Compressive Strength, Minimum: 41 pounds per square inch.
   2. Materials:
      a. Cement: ASTM C150/C150M.
      b. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
      c. Admixtures: As recommended by lightweight (flowable) concrete fill manufacturer.
      d. Expansion Material: Manufacturer's recommended expansion material.
      e. Mix Design: By manufacturer.

E. Aggregate Base:

1. Under Exterior Concrete excluding Under Paving (sidewalks, curbs, gutters):
   a. New Aggregate Base:
      1) Road Base to conform to State DOT Specifications.
2. Under Exterior Mow Strips:
   a. 3/4 inch gravel.
3. Under Paving:
   a. New Aggregate Base:
      1) Road Base to conform to 1-1/2 inches minus State DOT Specifications and Gradations.
      2) Aggregate base shall be non-plastic.
   b. Reclaimed Asphalt and Concrete Pavement (RAP):
      1) Pulverized Portland or asphalt concrete paving mixed uniformly with existing aggregate base.
      2) Conform to following gradation:
         (a) Sieve Percent of Weight Passing
            (1) 2 inch (50.0 mm) 100
            (2) 1 1/2 inch (38.0 mm) 85 - 100
            (3) 3/4 inch (19.0 mm) 60 - 80
            (4) No. 4 (4.750 mm) 30 - 50
            (5) No. 200 (0.075 mm) 5 - 12
      3) Quality Requirements as established by testing:
         (a) R-value (CBR value as per ASTM D1883): 70 percent minimum.
      4) Sand Equivalent (ASTM D2419): 25 percent minimum.
      5) ASTM C131/C131M (Los Angeles Abrasion): 50 percent maximum.
         (a) ASTM D4318 (Atterberg Limits): Non-Plastic.
4. Under Interior Concrete Slab-On-Grade:
   a. New Aggregate Base:
      1) Gravel: 3/4 inch minimum to one inch maximum well-graded, clean gravel or crushed rock.
      2) Base type gravel or crushed rock, graded by weight (three-quarter to one-inch clean gap-graded gravel); road Base type gravel or crushed stone (slag not allowed). Conform to the following gradation:
         (a) Sieve Percent of Weight Passing
            (1) 2 inch (50.0 mm) 100
            (2) 1 1/2 inch (38.0 mm) 85 - 100
            (3) 1 inch (25.4 mm) 100
            (4) 3/4 inch (19.0 mm) 80 - 90
            (5) 1/2 inch (12.7 mm) 20 - 40
            (6) 3/8 inch (9.5 mm) 5 -10
            (7) No. 4 (4.750 mm) 0 12

F. SOURCE QUALITY CONTROL
   1. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.
   2. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
   3. If tests indicate materials do not meet specified requirements, change material and retest.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Verify areas to be filled are not compromised with surface or ground water.

### 3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.
   1. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Before placing fill, aggregate base, or finish work, prepare existing subgrade as follows:
   1. Under Building Slab, Equipment Pad, Under Driveways, Parking, Under Miscellaneous Concrete Site Elements And Outside Face of Foundation Wall Areas:
      a. Do not place fill or aggregate base over frozen subgrade.
      b. Moisture condition to uniform moisture content of between optimum and four (4) percent over optimum, and mechanically compact 6 inches deep to ninety-five (95) percent minimum of relative compaction.
      c. Finish grade to grades required by Contract Documents.
   2. Landscape Areas:
      a. Compact subgrade to eight-five (85) percent relative compaction.

C. Aggregate Base:
   1. Do not perform work during unfavorable conditions as specified below:
      a. Presence of free surface water.
      b. Over-saturated sub base materials.

D. Vapor Retarder under Interior Concrete Slab-on-Grade:
   1. Unacceptable conditions for installation include presence of high winds which would tear or damage vapor retarder.

E. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

F. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

**3.03 PERFORMANCE**

A. Interface With Other Work:
   1. Section 31 2200 - Grading for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
   2. Section 31 2200 - Grading for grading of subgrade below aggregate base and topsoil.
   3. Do not place fill or aggregate base material when subgrade is frozen or unstable.
   4. Remove all standing water before placing fill or aggregate base material.

B. Fill:
   1. General:
      a. Do not fill against bituminous dampproofing to exterior of font foundation walls for twenty-four (24) hours after application of dampproofing.
      b. Before backfilling, show utility and service lines being covered on record set of Drawings. Do not backfill until utilities involved have been tested and approved by Architect and until instructed by Architect.
      c. Around Buildings And Structures: Slope grade away from building as specified unless noted otherwise in Contract Drawings. Hand backfill when close to building or where damage to building might result.
      d. Site Utilities:
         1) In Landscape Areas: Use backfill consisting of on-site soil.
         2) Under Pavement and Concrete Site Elements: Extend excavatable flowable fill/backfill to elevation of subgrade. Do not place aggregate base material until excavatable flowable fill/backfill has cured seventy-two hours.
      e. Do not use puddling or jetting to consolidate fill areas.

C. Compacting:
   1. Fill And Aggregate Base:
      a. Under Interior Concrete Slabs on Grade:
         1) Fill:
            (a) Place in 8 inch maximum uncompacted layers, moisture condition to plus or minus two (2) percent of optimum moisture content and mechanically

compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.

2) Aggregate Base:
   (a) Place 4 inches minimum of aggregate base under vapor retarder, level, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.
3) Vapor Retarder:
   (a) Install vapor retarder in accordance with ASTM E1643 except where Contract Documents indicate otherwise and following instructions:
      (1) Install vapor retarder over aggregate base over compacted subgrade so entire area under slab is covered.
      (2) Install vapor retarder in accordance with ASTM E1643 at interior stem walls.
   (b) Lap joints 6 inches (150 mm) minimum and seal with specified seam tape.
      (1) Seal vapor retarder around pipes, conduits, and other utility items that penetrate vapor retarder using factory-fabricated boot installed as recommended by Manufacturer.
      (2) Except for punctures required for reinforcing and anchor bolts at top of stem walls, seal tears and punctures.

b. Equipment Pad Areas:
1) Fill:
   (a) Place in 8 inch maximum uncompacted layers, moisture condition to plus or minus two (2) percent of optimum moisture content and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.
2) Aggregate Base:
   (a) Place 4 inches minimum of aggregate base, level, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.

c. Under Driveways, Truck Areas, And Parking Areas:
1) Fill:
   (a) Place in 8 inch maximum uncompacted layers, dampen but do not soak, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1557.
2) Aggregate Base:
   (a) Use 6 inches minimum aggregate base under paving for meetinghouse and CES projects, unless noted otherwise in Contract Drawings, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.
   (b) Use 8 inches minimum of aggregate base for Welfare Services Projects except use 12 inches minimum in truck areas, unless noted otherwise in Contract Drawings, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.
   (c) Priming: Prime aggregate base with application of 0.2 to 0.5 gallons (2 to 5 liters) of asphalt cement primer per square yard (meter) if pavement will be laid more than three days after compaction of aggregate base, or if precipitation is anticipated between completion of compaction of aggregate base and laying of asphalt paving.
   (d) Recompact unprimed aggregate base if it receives precipitation before pavement is laid.
   (e) Remove or repair improperly prepared areas as directed by Architect.

2. Under Miscellaneous Concrete Site Elements (sidewalks, curbs, gutters, not mow strips) And Outside Face of Foundation Walls:
   a. Fill:

1) Place in 8 inch maximum uncompacted layers, dampen but do not soak, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1557.

b. Aggregate Base:

1) Four inches minimum of aggregate base. Level, and mechanically compact to ninety-five (95) percent minimum of maximum laboratory density as established by ASTM D1157.

3. Under Exterior Mow Strips:

a. Aggregate Base:

1) 6 inches of 3/4 inch gravel.

4. Utility Trenches:

a. Site:

1) Fill:

(a) Place fill in 12 inch maximum uncompacted layers and moisture condition to plus or minus two (2) percent of optimum moisture content.

(b) Compact fill to ninety-five (95) percent minimum relative compaction to within 12 inches of finish grade.

(c) Compact fill above 12 inches to eight-five (85) percent relative compaction.

b. Under Miscellaneous Slabs:

1) Fill:

(a) Place in 6 inch maximum uncompacted layers, moisture condition to plus or minus two (2) percent of optimum moisture content, and compact to ninety-five (95) percent minimum relative compaction to within 4 inches of finish grade.

2) Aggregate Base:

(a) Place 4 inches minimum of aggregate base, level, and compact. as specified in Part 3.

5. Fill Slopes: Compact by rolling or using sheepsfoot roller.

6. Backfill Under Footings if required by geotechnical evaluation report.

7. Landscape Areas:

a. Compact fill to eighty-five (85) percent minimum relative compaction.

8. Other Backfills: Place other fills in 12 inch maximum uncompacted layers and compact to ninety-five (95) percent relative compaction.

9. Loose material from compacted subgrade surface shall be immediately removed before placing compacted fill or aggregate base course.

D. Fill to contours and elevations indicated using unfrozen materials.

E. Employ a placement method that does not disturb or damage other work.

F. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Slope grade away from building minimum [___], unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

**3.04 LIGHTWEIGHT (FLOWABLE) CONCRETE FILL**

A. Install lightweight concrete fill according to manufacturer's written instructions.

B. Use batching, mixing, and placing equipment approved by the manufacturer.

C. Prevent segregation of material.

D. Tolerance: Finished surface within 2 inches of elevation indicated on drawings.

## 3.05 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
   1. Drainage fill and geotextile: Section 31 0519.
   2. Cover drainage fill with general fill.
   3. Fill up to subgrade elevation.
   4. Compact to 95 percent of maximum dry density.

## 3.06 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Paving Areas:
   1. Survey and stake parking surfaces to show grading required by Contract Drawings.
   2. Subgrade (soil below aggregate base):
      a. Prepare natural soil subgrade or fill.
   3. Aggregate Base:
      a. Finish grade parking surface are to grades as required by Contract Drawings.
         1) 0.00 inches high and no more than 1/2 inch low.
      b. Measure using string line from curb to curb, gutter, flat drainage structure, or grade break.
      c. Finished aggregate base course shall be true to line and grade within plus or minus 1/4 inch in 10 feet.
      d. Maximum variation from required grades shall be 1/10 of one foot.

## 3.07 REPAIR / RESTORATION

A. Repair damage to other portions of the Work resulting from work of this Section at no additional cost to Owner. On new work, arrange for damage to be repaired by original installer.

## 3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Field Tests and Inspections:
   1. Field tests and inspections and laboratory testing are provided by Owner's independent Testing Agency as specified in Section 01 4523.
      a. Quality Control is sole responsibility of Contractor:
         1) Owner's employment of an independent Testing Agency does no relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
            (a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
   2. Fill/Engineered Fill:
      a. Testing Agency shall provide testing and inspection for fill.
      b. Number of tests may vary at discretion of Architect.
      c. Testing Agency is to provide one (1) moisture-maximum density relationship test for each type of fill material.
      d. Prior to placement of engineered fill, inspector shall determine that site has been prepared in accordance with geotechnical evaluation report.
      e. Footing sugrade: At footing subgrades, inspector is to verify that soils confor to geotechnical evaluation report.
      f. Testing Agency will test compaction of soils according to ASTM D1556/D1556M, ASTM D2167, and ASTM D6938 as applicable. Lift thicknesses shall comply with geotechnical evaluation report. Inspector shall determine that in-place dry density of

engineered fill material complies with geotechnical evaluation report. Tests will be performed at following locations and frequencies:

1) Paved Areas: At each compacted fill and backfill layer, at least one (1) test for every 10,000 sq. ft. or less of paved areas but in no case less than three (3) tests.
2) Building Slab Areas: At each compacted fill and backfill layer, at least one (1) test for every 2,500 sq. ft. or less of building slab area but in no case less than three (3) tests.
3) Foundation Wall/Continuous Footing Backfill: At each compacted backfill layer, at least one (1) test for each 40 linear feet or less of wall length, but no fewer than two (2) tests.
4) Trench Backfill: At each 12 inch compacted lift for each 100 linear feet or less of trench length but no fewer than two (2) tests.
5) Sidewalks, Curbs, Gutters, Exterior Pads: Minimum of one (1) test for each lift for each 40 linear feet or one (1) test for every 5,000 sq. ft. or less of pad area but no fewer than three (3) tests.

3. Aggregate Base:
   a. Interior slab-on-grade concrete areas:
      1) Testing Agency shall provide testing and inspection for interior aggregate base.
      2) Number of tests may vary at discretion of Architect.
      3) Testing Agency will test compaction of base in place according to ASTM D1556/D1556M, ASTM D2167, and ASTM D6938, as applicable. Tests will be performed at following frequency:
         (a) Building Slab Areas: One test for every 2,500 sq. ft. (232 sq. m) or less of building slab area but no fewer than three tests.
   b. Miscellaneous exterior concrete areas:
      1) Testing Agency shall provide testing and inspection for exterior aggregate base.
      2) Number of tests may vary at discretion of Architect.
      3) Testing Agency will test compaction of base in place according to ASTM D1556/D1556M, ASTM D2167, and ASTM D6938, as applicable. Tests will be performed at following frequency:
         (a) Sitework Areas: One test for every 10,000 sq. ft. (930 sq. m) or less of exterior pads area but no fewer than three tests.
   c. Paving area:
      1) Testing Agency shall provide testing and inspection for exterior aggregate base.
      2) Number of tests may vary at discretion of Architect.
      3) Testing Agency will test compaction of base in place according to ASTM D1556/D1556M, ASTM D2167, and ASTM D6938, as applicable. Tests will be performed at following frequency:
         (a) Sitework Areas: One test for every 10,000 sq. ft. (930 sq. m) or less of exterior pads area but no fewer than three tests.

C. Lightweight (Flowable) Concrete Fill:
   1. Sampling: During initial placement, take four 3 inch by 6 inch3 inch by 6 inch test specimens per 303 cubic yards of material placed or for each four hours of placement work.
   2. Testing: Provide third-party testing of samples in accordance with ASTM C796/C796M except do not oven-dry load-test specimens.

**3.09 PROTECTION**

A. Interior Slab-On-Grade Concrete:
   1. Vapor Retarder:
      a. Do not allow water onto vapor retarder or aggregate base before placing concrete.
      b. Protect membrane from possible punctures caused by reinforcing bar supports before placing concrete.

### 3.10 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

**END OF SECTION**

**SECTION 31 3116**
**TERMITE CONTROL**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete soils treatment with termiticide under and adjacent to building to provide uniform toxic barrier continuous treated zone in all routes of termite entry.

B. Related Requirements:
   1. Section 31: Earthwork.
      a. Section 31 0501: 'Common Earthwork Requirements'.
      b. Section 31 1123: 'Aggregate Base':
         1) Installation of below-grade vapor retarder.
         2) Installation of geomembrane.
      c. Section 31 2216: 'Fine Grading'.

### 1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate soil treatment application with excavation, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
   2. Interior slab-on-grade concrete:
      a. Coordinate work so vapor retarder can be installed as soon as possible after application of termite protection on top of soil base or aggregate base.

B. Pre-Installation Conference:
   1. Participate in mandatory pre-installation conference.
   2. Schedule pre-installation conference for new Projects after completion of Fine Grading specified in Section 31 2216, but before beginning Aggregate Base as specified in Section 31 1123. This conference may be held jointly with pre-installation conference for Common Planting Requirements specified in Section 32 9001.
   3. In addition to agenda items specified in Section 01 3100, review following:
      a. Review Applicator Qualification requirements.
      b. Review Ambient Conditions for acceptability for application of termiticide products.
      c. Review Delivery, Storage, and Handling requirements.
      d. Review Examination, Preparation, and Application requirements as called out in Part 3 Execution.
      e. Review Field Quality Control and Protection requirements as called out in Part 3 Execution.

C. Sequencing:
   1. Application OPTION A:
      a. Apply termite protection on top of soil base before aggregate base and vapor retarder is installed.
   2. Application OPTION B:
      a. Install vapor retarder after application of termite protection on top of aggregate base.
      b. Increase application rate for volume as per Manufacturer's instruction.
      c. Install below-grade vapor retarder on top of soil base or aggregate base.

### 1.03 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Submit Chemical Manufacturer's printed literature regarding chemical composition, concentration, and rates and method of application.
      b. Submit MSDS information.

B. Informational Submittals:
   1. Certificates:
      a. Provide certificates required by any authorities having jurisdiction (AHJ).
   2. Design Data Submittals:
      a. Certified Applicator's statement indicating total amount of chemical required for Project to provide required amount of mix solution at specified concentration and application rates.
      b. Certified Applicator to submit take-off showing amounts of square foot and lineal foot application at specified application rate. Also indicate total amount of mix solution required for Project.
   3. Manufacturers' Instructions:
      a. Manufacturer's printed label on product regarding chemical composition, concentration, and rates and method of application.
   4. Qualification Submittals:
      a. Provide BASF Partner Number and evidence of license from authorities having jurisdiction (AHJ).

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Include copy of final, executed warranty.
      b. Record Documentation:
         1) Soil Treatment Application Report: After application of termiticide is complete, submit report including the following:
            (a) Date and time of application.
            (b) Moisture content of soil before application.
            (c) Termiticide brand name and batch number of concentrate.
            (d) Mix rate and quantity of diluted termiticide used.
            (e) Areas of application.
            (f) Weather at time of application.
            (g) Water source for application.

## 1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

B. Qualifications:
   1. Applicator: Requirements of Section 01 4301 applies but not limited to the following:
      a. Applicator shall be licensed pest professional according to regulations of authorities having jurisdiction (AHJ) with Manufacturer's Certification training in correct application methods to apply termite control treatment and products in jurisdiction where Project is located.
      b. Applicator should be familiar with trenching, roddlng, short rodding, subslab injection, low-pressure banded surface applications, and foam delivery techniques.

C. Source Limitations:
   1. Obtain termite control products from single source from single manufacturer.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Storage, and Handling:
   1. Certified Applicator responsible for delivery, storage, handling, and dispose of specified products of this section.

B. Storage And Handling Requirements:
   1. Storage:
      a. Keep containers closed when not in use.

b. Store unused product in original container only, out of reach of children and animals.
c. Do not store near food or feed.
d. Protect from freezing.

2. Spills or leaks:
   a. General:
      1) In case of spill or leak on floor or paved surfaces, soak up with sand, earth, or synthetic absorbent.
      2) Avoid skin contact.
      3) Remove residue to chemical waste area.
      4) Ensure adequate decontamination of tools and equipment following cleanup.
   b. All leaks resulting in application of this product in locations other than those prescribed must be cleaned up prior to leaving application site.
      1) DO NOT allow people or pets to contact contaminated areas until cleanup is completed.
      2) Existing building: DO NOT allow people to reoccupy contaminated areas of structure until cleanup is completed.

C. Packaging Waste Management:
   1. Disposal:
      a. Dispose of empty containers in accordance with Manufacturer's and regulatory agency's requirements.
      b. Do not contaminate water, food, or feed by storage or disposal.

## 1.06 FIELD CONDITIONS

A. Ambient Conditions
   1. Comply with EPA-Registered Label and requirements of authorities having jurisdiction (AHJ) and Manufacturer’s written recommendations regarding environmental conditions under which termiticide shall be applied.

B. Environmental Limitations:
   1. To ensure penetration, do not treat soil that is water saturated or frozen.
   2. Do not treat soil (or aggregate base) while precipitation is occurring or movement from treatment area (site) is likely to occur.
   3. Do not treat soil (or aggregate base) while large precipitation is expected to occurring within two to four (2-4) hours after application.

## 1.07 WARRANTY

A. Manufacturer Warranty:
   1. Provide Manufacturer’s written warranty:
      a. Warranty shall guarantee effectiveness of treatment against subterranean termite infestation for five (5) years minimum from acceptance date of Project and be signed by applicator and Contractor as co-guarantors.
      b. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

# PART 2 PRODUCTS

## 2.01 MATERIALS

A. Termiticide:
   1. Description:
      a. Provide EPA-Registered termiticide, complying with requirements of authorities having jurisdiction (AHJ), in aqueous solution formulated to prevent termite infestation.
      b. Provide quantity required for application at label volume and rate for maximum termiticide concentration allowed for each specific use, according to product’s EPA-Registered Label.
   2. Design Criteria:

a. Undetectable:
    1) Non-repellent or undetectable chemical technology.
b. Transfer Effect:
    1) Slow-acting treatment allowing individual termite's ample time to transfer treatment to other termites as they come in contact within the colony.
c. Service Life of Treatment:
    1) Soil treatment termiticide that is effective for not less than five (5) years against infestation of subterranean termites.

3. Mixes:
    a. Mix chemicals and water at Manufacturer's recommended printed requirements.
        1) To provide maximum control and protection against termite infestation, apply as per Manufacturer printed instructions including but not limited to the following:
            (a) To maximize termiticide potency, product should be applied in manner to provide continuous treated zone to prevent termites from infesting wood to be protected.
            (b) Product is labeled for use at 0.06 percent, 0.09 percent or 0.125 percent finished dilution. The 0.06 percent finished dilution should be used for typical control situations. Where severe termite infestations, problem soils, or difficult construction types are encountered, it may be advisable to use either 0.09 percent or 0.125 percent.
4. Approved Product
    a. Termidor by BASF Professional Pest Control, Research Triangle Park, NC www.termidorhome.com, or www.pestcontrol.basf.us.
    b. Or approved Equal.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Evaluation And Assessment:
1. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
2. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

A. Protection Of In-Place Conditions:
1. Allow no disturbance of treated soil (aggregate base) between application of solution and placing of concrete. (Disturbed defined as removing fill and/or replacing fill).
2. Protect neighboring property, water sources, and personnel on site from contamination.
    a. Use anti-backflow equipment or procedures.
    b. Do not treat soil beneath structures that contain wells or cisterns.
    c. Take extreme care to avoid runoff. Do not treat soil that is water-saturated or frozen.
3. Maintain, on job site, empirical name of chemical, Manufacturer's precautions, and phone numbers of proper authorities to notify in case of spillage or other accident.

B. General Preparation:
1. Comply with the most stringent requirements of authorities having jurisdiction (AHJ) and with Manufacturer's written instructions for preparation before beginning application of termite control treatment.
2. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, trash, and construction waste wood from soil within and around foundations.
3. Do not apply application of termite control until location of air ducts, vents, water, and sewer lines are known and identified. Take extreme caution to avoid contamination of these structural elements and airways.

C. Soil Treatment Preparation:
   1. Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated.
   2. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings.
   3. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
   4. Fit filling hose connected to water source at site with backflow preventer, complying with requirements of authorities having jurisdiction (AHJ).

**3.03 APPLICATION**

A. Interface With Other Work:
   1. Interior slab-on-grade concrete:
      a. Installation of vapor retarder, geomembrane if used, and aggregate base.

B. General:
   1. Comply with the most stringent requirements of authorities having jurisdiction (AHJ) and with Manufacturer's EPA-Registered Label for products.
      a. Application Restrictions:
         1) Do not apply while precipitation is occurring or large precipitation is expected to occurring within two to four (2-4) hours after application'.
         2) Do not contaminate water, food or feed. Cover or remove all exposed food, feed and drinking water.
         3) Do not apply with 15 feet (4.50 m) of bodies of fresh water lakes, reservoirs, rivers, permanent streams, marshes, and natural ponds.
         4) Do not allow residents, children, other persons or pets into immediate area during application.
         5) Do not allow residents, children, other persons or pets into treated area until sprays have dried. After application, applicator is required to check for leaks resulting in deposition of treatment dilution in locations other than those prescribed.
         6) Do not apply to wasp or hornet nests if they are not attached to structure exterior or inside wall voids.
         7) Do no treat within distance of one foot (300 mm) out from drip line of edible plants.
         8) Do not spray air conditioning units or air intake vents.
         9) Doors and windows adjacent to application site must be closed during surface application.
   2. Application OPTION B as specified in Sequencing of this specification in Part 1 General:
      a. Increase application rate for volume as per Manufacturer's instruction.

C. Applying Soil Treatment:
   1. Mix treatment termiticide solution to a uniform consistency.
   2. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
   3. If impervious soils make reduction in volume of solution necessary, increase percentage of toxicant used in proportion to insure same amount of insecticide be used per linear or square foot (meter).
   4. Apply overall treatment to entire surface to be covered by concrete slab.

D. Pre-Construction Treatment:
   1. For Slab-on-Grade Construction:
      a. 4 gallons per 10 linear ft (15 liters per 3 000 linear mm) along outside of exterior foundation.

b. 2 gallons per 10 linear ft (7.5 liters per 3 000 linear mm) in voids of unit masonry foundation walls or piers.
c. One gallon per 10 sq ft (3.5 liters per one sq m) as overall treatment under slab and attached porches.
d. 4 gallons per 10 linear ft (15 liters per 3 000 linear mm) along inside of exterior foundation walls, both sides of interior partition foundation walls, and around utility services and other features that will penetrate slab or where there will be break in concrete (grade changes, zip strips, cold joints, etc.).

2. For Crawl-Space Construction:
   a. 4 gallons per 10 linear ft (15 liters per 3 000 linear mm) along inside of exterior foundation walls, both sides of interior partition foundation walls, and around utility services and other features that will penetrate floor of crawl space.
   b. 4 gallons per 10 linear ft (15 liters per 3 000 linear mm) along outside of exterior foundation walls.
   c. 2 gallons per 10 linear ft (7.5 liters per 3 000 linear mm) in voids of unit masonry foundation walls and piers.
3. For Basement Construction:
   a. Apply by trenching and rodding into trench or trenching along foundation at rate of 4 gallons (15 liters) finished dilution per 10 linear feet (3 000 linear mm) per 1 foot (300 mm) of depth, or if footing is more than 4 feet (1 200 mm) below grade, to minimum depth of 4 feet (1 200 mm).
   b. 2 gallons per 10 linear ft (7.5 liters per 3 000 linear mm) in voids of unit masonry foundation walls or piers.
   c. One gallon per 10 sq ft (3.5 liters per one sq m) as overall treatment under basement slab and to critical areas within basement areas such as along inside of foundation walls, along both sides of partition foundation walls, around piers, and around entrance of any utility service or other feature that will penetrate basement slab.

E. Treatment For Existing Construction:
1. Use sub-slab injection, rodding, or trenching with low-pressure spray.
2. 4 gallons per 10 linear ft (15 liters per 3 000 linear mm) along outside of exterior foundation walls.
3. At locations of termite activity in building interior, expose or penetrate areas of termite activity within building and treat at rate of 4 gallons per 10 sq ft (15 liters per one sq meter) for 2 feet (600 mm) in two or more directions radiating from site.

**3.04 RE-APPLICATION**

A. Reapply treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

**3.05 FIELD QUALITY CONTROL**

A. Non-Conforming Work. Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
1. Applicator:
   a. Substitution of specified product or alteration of Manufacturer's application requirements is considered defective or not complying with Contract Document requirements. Correct such work at no cost to the Owner.

**3.06 PROTECTION**

A. Allow sufficient time (12 hours minimum) for drying after application before resuming construction activities.

B. Keep off treated areas until completely dry. Do not allow workers or other personnel to enter treatment area until chemical has been absorbed into soil.

C. Protect application areas from precipitation as recommended by Manufacturer.

D. Protect temiticide solution, dispersed in treated soils and fill, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

E. Post signs in areas of application warning of poison application. Remove signs when areas with application are covered by other construction.

**END OF SECTION 31 3116**

**SECTION 32 1216.03**
**ASPHALT PAVING - MARSHALL MIX**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install asphalt paving in driveways and parking areas as described in Contract Documents including the following, but not limited to:
   a. Asphalt Mix Design Criteria Summary:

| | | |
|---|---|---|
| 1) | Asphalt Binder: | PG 58-28 (or Binder locally used by DOT) |
| 2) | Maximum Size Aggregate: | 1/2 inch<br>(1 inch for base layer with a 1-1/2 inch top layer is acceptable) |
| 3) | Marshall Blow Count: | 50 |
| 4) | Stability: | 1200 pounds minimum |
| 5) | Flow: | 8 minimum, 16 maximum |
| 6) | Antistrip Agent: | If required by supplier's mix design (use 1 percent or greater lime slurry when required |
| 7) | Asphalt Reinforcement Fibers: | Specified in Section 32 1217 as Alternate 'A'.<br>(not allowed in Welfare Services Projects) |
| 8) | Reclaimed Asphalt Pavement (RAP): | Allowed up to 25 percent. Asphalt binder shall be one grade softer when more than 15 percent RAP is used. |
| 9) | ROSP: | Not allowed. |
| 10) | Mineral Filler: | Not allowed |
| 11) | Warm Mix Additive: | If required by supplier's mix design. |
| 12) | Recycle Agent: | If required by supplier's mix design. |

   b. Design Air Voids:
      1) Three and one-half percent (3.5 percent).
   c. Tack Coat: Application of asphaltic material to existing asphalt concrete or Portland concrete surfaces before asphalt concrete pavement.
   d. Blotter materials and procedures for absorbing excess asphalt as required.

B. Related Requirements:

1. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
2. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
3. Section 01 4301: 'Quality Assurance - Qualifications' establishes minimum qualification levels required.
4. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
5. Section 01 7800: 'Closeout Submittals'.
6. Section 31 0500: 'Common Earthwork Requirements' for:
   a. General procedures and requirements for earthwork.
   b. Pre-installation conference held jointly with other common earthwork related sections.
7. Section 31 2323: ' Fill and Aggregate Base' for compaction of aggregate base.
8. Section 31 2323: 'Fill and Aggregate Base' for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
9. Section 31 22323: 'Fill and Aggregate Base' for grading of subgrade below aggregate base and topsoil.

10. Section 31 2323: 'Fill and Aggregate Base' for compaction procedures and tolerances.
11. Section 32 0113.01: 'Asphalt Paving Surface Treatment: Penetrating Seal'.
12. Section 32 1717: 'Asphalt Reinforcement Fibers'.
13. Section 32 1723: 'Pavement Markings'.

## 1.02 PRICE AND PAYMENT PROCEDURES

A. Alternates:
1. Asphalt Reinforcement Fibers are bid as Alternate 'A' as specified in Price and Payment Procedures in Part 1 of Section 32 1216. Owner's Representative will review bid and decide if asphalt reinforcing fibers will be included in Project.

## 1.03 REFERENCES

A. Association Publications:
1. Asphalt Institute, 2696 Research Park Dr., Lexington, KY www.asphaltinstitute.org:
   a. MS-2, 'Mix Design Methods' (7th Edition 2015).
      1) Definitions:
2. Aggregate: Hard inert mineral material, such as gravel, crushed rock, slag, or sand.
   a. Coarse Aggregate: Aggregate retained on or above No. 8 sieve.
   b. Coarse-Graded Aggregate: Aggregate having predominance of coarse sizes.
   c. Dense-Graded Aggregate: Aggregate that is graded from maximum size down through filler with object of obtaining an asphalt mix with controlled void content and high stability.
   d. Fine Aggregate: Aggregate passing No. 8 sieve.
   e. Fine-Graded Aggregate: Aggregate having predominance of fine sizes.
   f. Mineral Filler: Fine mineral product at least 70 percent of which passes a No. 200 (75µm) sieve.
3. Air Voids: Total volume of small air pockets between coated aggregate particles in asphalt cement concrete (ACC); expressed as percentage of bulk volume of compacted paving mixture.
4. Anti-Stripping Agent: Chemicals added to bitumen to improve the adhesion of the bitumen to hydrophilic aggregates
5. Asphalt Binder: Asphalt cement or modified asphalt cement that binds aggregate particles into dense mass.
   a. Asphalt Cement used in paving applications that has been classified according to the Standard Specification for Performance Graded Asphalt Binder, AASHTO Designation MP 320. It can be either unmodified or modified Asphalt Cement, as long as it complies with specifications.
6. Asphalt-Aggregate Designator: Alpha-numeric code that indicates nominal maximum size of aggregate, and type and grade of asphalt in aggregate-asphalt mix.
   a. Example: "12.5 PG70-28" means aggregate asphalt mix shall be composed of aggregate gradation with 12.5 mm (1/2 inch) nominal maximum size and performance grade asphalt binder designed to perform between temperatures of 70 deg C and -28 deg C (158 deg F and -18.4 deg F).
7. Equivalent Single Axle Load (ESAL): Effect on pavement performance of any combination of axle loads of varying magnitude equated to number of 18,000-lb. single-axle loads that are required to produce an equivalent effect.
8. Performance Graded Asphalt Binder (PGAB): Asphalt binder designed to produce HMA that meets certain performance standards. Designations for performance-graded asphalt binders are prefixed with PG. Each grade designation also includes two sets of numbers that denote temperature range. This is a range of climate temperatures to which road may be exposed and still be expected to give superior performance. PG numbers do not indicate viscosity as in conventional liquid asphalt designations.
9. Pre-emergent Herbicide: Chemical that is applied before weeds emerge. It acts by killing weed seedlings and /or establishing layer of chemical on or near soil surface that is toxic to germinating seeds and young seedlings.

10. Reclaimed Asphalt Pavement (RAP): Existing asphalt mixture that has been pulverized, usually by milling, and is used like an aggregate in recycling of asphalt pavements.
11. Subgrade (definition varies depending upon stage of construction and context of work being performed):
    a. Prepared natural soils on which fill, aggregate base, or topsoil is placed.
    b. OR
    c. Prepared soils immediately beneath paving.
12. Tack Coat: Very light application of liquid asphalt, or asphalt emulsion diluted with water.

B. Reference Standards:
1. American Association of State and Highway Transportation Officials:
    a. AASHTO T 304-17, ‘Standard Method of Test for Uncompacted Void Content of Fine Aggregate’.
    b. AASHTO T 322-07(2016), ‘Standard Method of Test for Determining the Creep Compliance and Strength of Hot-Mix Asphalt (HMA) Using the Indirect Tensile Test Device.
2. ASTM International:
    a. ASTM C29/C29M-17a, ‘Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate'.
    b. ASTM C88-13, ‘Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate'.
    c. ASTM C131/C131M-14, 'Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine’.
    d. ASTM C142/C142M-17, ‘Standard Test Method for Clay Lumps and Friable Particles in Aggregates'.
    e. ASTM D242/D242M-09(2014), ‘Standard Specification for Mineral Filler For Bituminous Paving Mixtures'.
    f. ASTM D977-17, 'Standard Specification for Emulsified Asphalt’.
    g. ASTM D979/D979M-15, 'Practice for Sampling Bituminous Paving Mixtures'.
    h. ASTM D2041/D2041M-11, 'Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures’.
    i. ASTM D2172/D2172M-17, ‘Standard Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures’.
    j. ASTM D2256/ D2256M-10(2015), ‘Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method’.
    k. ASTM D2397/D2397M-17, 'Standard Specification for Cationic-Emulsified Asphalt’.
    l. ASTM D2419-14, ‘Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate'.
    m. ASTM D2726/D2726M-17, 'Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures’.
    n. ASTM D2950/D2950M-17, ‘Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods'.
    o. ASTM D3203/D3203M-11, ‘Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures'.
    p. ASTM D3549/D3549M-17, ‘Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens’.
    q. ASTM D3665-12(2017), ‘Standard Practice for Random Sampling of Construction Materials’.
    r. ASTM D4318-17, ‘Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils’.
    s. ASTM D4552/D4552M-10(2016), ‘Standard Practice for Classifying Hot-Mix Recycling Agents'.
    t. ASTM D4791-10, ‘Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate’...

u. ASTM D5444-15, ‘Standard Method for Mechanical Size Analysis of Extracted Aggregate'.
v. ASTM D5821-13(2017), ‘Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate’.
w. ASTM D6307-16, ‘Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method'.
x. ASTM D6931-17, ‘Standard Test Method for Indirect Tensile (IDT) Strength of Bituminous Mixtures’.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
1. Participate in MANDATORY pre-installation conference as specified in Section 31 0500 ‘Common Earthwork Requirements’:
2. In addition to agenda items specified in Section 01 3100 ‘Project Management and Coordination’ and Section 31 0500 ‘Common Earthwork Requirements’, review following:
a. Review surveying and staking of parking areas and installation of sleeves.
b. Review proposed aggregate base schedule.
c. Review rough grading elevations before fine grading operations.
d. Review fine grading elevations of subgrade fine grading operations before placing aggregate base and paving.
e. Review proposed asphalt paving schedule.
f. Review asphalt paving mix design.
g. Review pre-emergent herbicide protection of adjoining property and planting area on site requirements, schedule and application requirements.
h. Review schedule of mandatory asphalt paving surface treatment to be applied after placement of asphalt paving.
i. Review schedule of paint stripes to be applied after asphalt paving surface treatment.
j. Review safety issues.
k. Review Section 01 4523 ‘Testing and Inspecting Services’ for administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
1) Review requirements and frequency of testing and inspections.
2) Review Contractor Testing Agency Qualifications.
3. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing asphalt paving.

## 1.05 SUBMITTALS

A. Action Submittals:
1. Product Data:
a. Pre-Emergent Herbicide:
1) Manufacturer's published product data on pre-emergent herbicide.
B. Informational Submittals:
1. Certificates:
a. Require mix plant to furnish delivery/load tickets for each batch of asphalt. Keep delivery tickets at job-site for use of Owner’s Representative. Tickets shall show following:
1) Name of mix plant.
2) Name of contractor.
3) Name and location of Project.
4) Serial number of ticket.
5) Asphalt mix type.
6) Time loaded.
7) Identity of truck.

b. Installer to provide Manufacturer's Certificate of Compliance stating material authenticity and properties for review and acceptance by Architect before product use.

2. Design Data:
   a. Hot Mix Asphalt:
      1) Design Criteria:
         (a) Develop mix design according to current Asphalt Institute MS-2, 'Mix Design Methods' for Marshall Method.
         (b) Submittal format:
            (1) Design mix submittal shall follow format as indicated in current Asphalt Institute MS-2, 'Mix Design Methods.
      2) Mix design of asphalt paving must meet Design Criteria minimum requirements and show conformance to the following:
         (a) Location and name of hot mix asphalt concrete production facility.
         (b) Date of mix design. If older than two (2) years, recertify mix design.
         (c) Asphalt mix type.
         (d) Mix design method used.
         (e) Mix density.
         (f) Design air voids (three and one half (3.5) percent.
         (g) Asphalt content in percent.
         (h) Performance grade of asphalt binder.
         (i) Nominal maximum size of aggregate.
         (j) Aggregate source and gradation.
         (k) Mix properties and design parameters.
         (l) Temperature of mix at plant and in the field for optimum field compaction.
         (m) Amount of recycled asphalt pavement (RAP).
         (n) Mineral fillers, antistrip, and recycle agent percentages.
         (o) Identify if warm mix technologies will be used and how much warm mix additive will be used.
      3) Within thirty (30) days prior to asphalt construction, submit actual design mix to Architect, Civil Engineering Consultant of Record and Independent Testing Laboratory for review and approval.
3. Test And Evaluation Reports:
   a. Hot Mix Asphalt:
      1) Contractor's Testing Agency copies of Field Test results to show compliance with all contract requirements and quality control for quality of asphalt mixture and asphalt installation.
      2) Owner's Testing Agency copies of Field Tests and Inspections used to validate or determine discrepancies with testing by Contractor.
4. Manufacturer Instructions:
   a. Pre-Emergent Herbicide:
      1) Application instructions for pre-emergent herbicide.
5. Qualification Statement:
   a. Installer:
      1) Provide Qualification documentation if requested by Owner's Representative.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800 'Closeout Submittals':
      a. Record Documentation:
         1) Manufacturer's documentation:
            (a) Pre-emergent herbicide documentation.
            (b) Asphalt paving design.
            (c) Test reports.

(d) Certificates from mix plant of delivery/load tickets.
(e) Manufacturer's Certificate of Compliance.
2) Testing and Inspection Reports:
(a) Testing Agency Testing and Inspecting Reports of asphalt paving.

## 1.06 QUALITY ASSURANCE

A. Qualifications. Requirements of Section 01 4301 'Quality Assurance - Qualifications' applies but not limited to following:
1. Asphalt Paving:
a. Foreman of asphalt paving crew has completed at least three (3) projects of similar size and nature.
b. Upon request, submit documentation.
2. Pre-emergent herbicide:
a. Applicator:
1) Pre-emergent herbicide shall be applied by applicator certified by State in which Project is located as an applicator of agricultural chemicals.

B. Testing and Inspection:
1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
2. Owner will provide Testing and Inspection for asphalt paving:
a. Owner will employ testing agencies to perform testing and inspection for asphalt paving as specified in Field Quality Control in Part 3 of this specification.
1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
2) See Section 01 1200: 'Multiple Contract Summary'.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Asphalt Material:
a. Each shipment must:
1) Be uniform in appearance and consistency.
2) Show no foaming when heated to specified loading temperature.
b. Do not supply shipments contaminated with other asphalt types or grades than those specified:
1) Do not use petroleum distillate as a release agent.
2. Pre-emergent herbicide:
a. Materials shall be delivered in original, unopened packages with labels intact.
3. Storage And Handling Requirements:
a. Pre-emergent herbicide:
1) Do not freeze. Store in at temperatures above 41 deg F .
2) Follow Manufacturer's storage and handling requirements.

## 1.08 FIELD CONDITIONS

A. Ambient Conditions:
1. Pre-emergent herbicide:
a. Follow printed Manufacturers instruction for environmental hazards:
b. Follow printed Manufacturers instruction ambient conditions for application of product.
2. Tack Coat:
a. Apply only when air and roadbed temperatures in shade are greater than 40 deg F. Temperature restrictions may be waived only upon written authorization from Architect or Civil Engineer.
b. Do not apply to wet surfaces.

c. Do not apply when weather conditions prevent tack coat from adhering properly.

3. Asphalt paving:
   a. Do not perform work during following conditions:
      1) Ambient temperature is below 45 deg F or will fall below 45 deg F during placement.
      2) Temperature of aggregate base below 50 deg F .
      3) Cold Weather Asphalt Paving Plan: If asphalt pavement is placed outside of these temperature limits or those identified in MINIMUM Temperature Degrees, a plan is required which includes:
         (a) Haul times.
         (b) Placement details.
         (c) Compaction aids used in production.
         (d) Owner does not assume responsibility for asphalt when placed outside temperature limits.
      4) Presence of free surface water or weather is unsuitable.
      5) Over-saturated aggregate base and subgrade materials.
      6) Wind or ground cools mix material before compaction.

**PART 2 PRODUCTS**

**2.01 DESIGN CRITERIA:**

A. General:
   1. Follow current Asphalt Institute MS-2 ‘Asphalt Mix Design Methods’ for Marshall Method.

B. Asphalt Mix:
   1. Asphalt Binder:
      a. Performance Graded Asphalt Binder:
         1) Use performance graded asphalt binder identified under Asphalt Mix Design Criteria.
   2. Aggregates:
      a. Use clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.
      b. Provide aggregate material properties to meet Table 1 – AGGREGATE PHYSICAL PROPERTIES requirements:

Table 1 –AGGREGATE PHYSICAL PROPERTIES

| Property | ASTM | ESAL | Min | Max |
|---|---|---|---|---|
| Coarse Aggregate (does not pass No. 4 sieve) | | | | |
| Angularity (fractured faces), percent | D5821 | less than 0.3 | 55 | -- |
| | | 0.3 to 3.0 | 75 | -- |
| | | greater than 3.0 | 85/80 | -- |
| Wear (hardness or toughness), percent | C131/C131M | less than 0.3 | -- | 40 |
| | | 0.3 to 3.0 | -- | 35 |
| | | greater than 3.0 | -- | 35 |
| Flats or elongates (3:1 length to width), percent, maximum | D4791 | -- | -- | 20 |
| Fine Aggregate (passing No. 4 sieve) | | | | |
| Angularity (uncompacted void content), percent (AASHTO T304) | -- | less than 0.3 | -- | -- |
| | | 0.3 to 3.0 | 40 | -- |
| | | greater than 3.0 | 45 | -- |
| Sand equivalent, percent | D2419 | less than 0.3 | 40 | -- |
| | | 0.3 to 3.0 | 40 | -- |
| | | greater than 3.0 | 45 | -- |

| | | | | | |
|---|---|---|---|---|---|
| Friable particles, percent | | C142/C142M | -- | -- | 2 |
| Plastic limit, maximum | Liquid limit | D4318 | -- | -- | 25 |
| | Plastic limit | D4318 | -- | -- | 6 |
| Notes:<br>1. ESAL in millions.<br>2. Angularity by weight retained above 9 mm sieve, with at least one fractured face. 85/80 denotes 85 percent coarse aggregate has one fractured face and 80 percent has two or more fractured faces.<br>3. Wear of aggregate retained above 2.36 mm sieve unless specific aggregates have higher values are known to be satisfactory.<br>4. Flats or elongates retained above 4.75 mm sieve.<br>5. Friable particles passing No. 4.75 mm sieve.<br>6. Plasticity, passing No. 4.75 mm sieve. Aggregate is no-plastic even when filler material is added to aggregate. | | | | | |
| Blended Physical Properties | | | | | |
| Dry-rodded unit weight, lb/ft3, minimum | | C29/C29M | - | 75 | -- |
| Weight loss (soundness), percent, maximum | | C88 | | -- | 16 |
| Clay content or cleanliness (sand equivalent), percent | | D2419 | less than 0.3 | 45 | -- |
| | | | more than 0.3 | 60 | -- |
| Notes:<br>1. Weight loss using sodium sulfate.<br>2. Sand equivalent value is after going through dryer or before drum mixer. The sand equivalent requirement is waived for RAP aggregate but applies to remainder of aggregate blend.<br>3. Friable particles of clay lumps, shale, wood, mica, and coal passing 4.75 sieve. | | | | | |

3. Admixture:
   a. Antistrip: Heat stable, cement slurry, dry lime, or liquid antistrip:
      1) Add if mix is moisture sensitive as determined by 'Moisture Susceptibility' paragr aph below.
   b. Mineral Filler: Comply with requirements of ASTM D242/D242M.
   c. Recycle Agent: Comply with requirements of ASTM D4552/D4552M.

**2.02 MATERIAL**

A. Aggregate Base: Conform to applicable requirements as specified in Section 31 2323 - Fill and Aggregate Base.

B. Asphalt Paving Surface Treatment:
   1. Include mandatory Asphalt Paving Surface Treatment to be applied no sooner than thirty (30) days or no later than eighteen (18) months of placing Asphalt Paving to be included with this project:
      a. Asphalt Based Penetrating Seal as specified in Section 32 0113.01 ‘Asphalt Paving Surface Treatment: Asphalt Based Penetrating Seal’.

C. Pre-Emergent Herbicide:
   1. Design Criteria:
      a. Selective type pre-emergence control chemical containing twenty-five (25 percent) Prometon minimum for control of annual grasses and broadleaf weeds.
      b. Non-oil based sterilant.
      c. Labeled for under-pavement use.
   2. Type Two Acceptable Products:
      a. Pramitol 25E Herbicide by WinField United, St Paul MN www.winfieldunited.com.

1) Apply at a rate of 10 gal per 1 acre conforming to application rates indicated on product label.

b. Equal as approved by Architect before installation. See Section 01 6200.

D. Recycled Asphalt Pavement, RAP. Aggregate Restrictions include:
1. Allowed up to 25 percent. Asphalt binder shall be one grade softer when more than 15 percent RAP is used.

E. Tack Coat:
1. Emulsified asphalt meeting requirements of ASTM D977, Grade SS-1H, CQS-1H, or ASTM D2397/D2397M, Grade CSS-1H.

## PART 3 EXECUTION

### 3.01 INSTALLERS

A. Approved Applicators. See Section 01 4301 'Quality Assurance - Qualifications':

### 3.02 PREPARATION

A. General:
1. Aggregate base and paving must be placed before any moisture or seasonal changes occur to subgrade that would cause compaction tests previously performed to be erroneous. Re-compact and retest subgrade soils that have been left exposed to weather.

B. Protection Of In-Place Conditions:
1. Pre-emergent herbicide:
a. Take necessary precautions to protect adjoining property and areas designated for planting on building site.
b. Do not contaminate any body of water by direct application, cleaning of equipment or disposal of wastes.
2. Asphalt Paving:
a. Protect all structures, including curb, gutter, sidewalks, guard rails and guide posts.
b. Protect neighborhood, storm drains and down-stream fish habitat.

C. Surface Preparation:
1. Survey and stake parking surfaces to show grading required by Contract Documents.
2. Subgrade (soil below aggregate base):
a. Prepare natural, or fill, soil subgrade as specified in Section 31 2223 - Fill and Aggregate Base
b. Application shall be no more than one (1) day before installation of granular road base.
3. Aggregate base:
a. Finish grade parking surface area to grades required by Contract Documents.
b. Compact aggregate base as specified in Section 31 2323 - Fill and Aggregate Base.
c. Tolerances:
1) Elevation of aggregate base shall be as specified in Section 31 2323 - Fill and Aggregate Base.
4. Tack coat:
a. Clean surface of all materials such as mud, dirt, leaves, etc. that prevent tack from bonding to existing surfaces.
1) If flushed, allow surface to dry.
5. Asphalt paving:
a. Area shall be clean and tack coat applied before placing of asphalt paving.
1) Remove all moisture, dirt, sand, leaves, and other objectionable material from prepared surface before placing asphalt.
2) Locate, reference, and protect all utility covers, monuments, curb, and gutter and other components affected by asphalt paving operations.
3) Allow sufficient cure time for tack coat before placing asphalt.

## 3.03 APPLICATION

A. Interface With Other Work:
   1. Section 31 2323 - Fill and Aggregate Base for compaction of aggregate base.
   2. Section 31 2223 - Fill and Aggregate Base for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
   3. Section 31 2323 - Fill and Aggregate Base for grading of subgrade below aggregate base and topsoil.
   4. Section 31 2323 - Fill and Aggregate Base for compaction procedures and tolerances.

B. Pre-Emergent Herbicide:
   1. Asphalt paving areas:
      a. Follow Manufacturer's printed application requirements:
      b. Apply to prepared subgrade dispersed in liquid. Concentrate shall be such that Manufacturer's full recommended amount of chemical will be applied to every 1000 sq ft and liquid will penetrate minimum of 2 inches.
      c. Application shall be no more than one (1) day before installation of aggregate base.

C. Tack Coat:
   1. General:
      a. Tack coat vertical surfaces or existing asphalt cement concrete or portland cement concrete that will be in contact with asphalt paving.
      b. Use tack coat diluted to a 2:1 (concentrate water) ratio.
      c. Use pressure distributor to apply in uniform, continuous spread.
      d. Cover all tacked surface areas with surfacing materials same day of application.
   2. Application rate. Typically as follows:
      a. Emulsions, 0.08 to 0.15 gallons per sq yd of diluted material:
         1) Apply sufficient to achieve ninety five (95) percent or better coverage of existing surfaces.
         2) Above application rates may vary according to field conditions. Obtain approval from Civil Engineer for quantities, rate of application, temperatures, and areas to be treated before any application.

D. Asphalt Paving:
   1. General:
      a. Paving adjacent to cast-in-place concrete site elements shall be between 1/4 inch higher than concrete.
      b. Surface texture of hand worked areas shall match texture of machine-laid areas.
      c. Surface shall be uniform with no 'birdbaths'. Leave finished surfaces clean and smooth. Variations from specified grades shall not exceed 1/2 inch.
      d. Cross Slope: 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.
      e. Grade: 1/8 inch in 10 feet parallel to centerline.
      f. Do not place on frozen aggregate base or during adverse climatic conditions such as precipitation or when roadway surface is icy or wet.
      g. Uniformly mix materials so aggregate is thoroughly coated with asphalt.
      h. Place at temperatures established by the mix design with self-propelled laydown machine.
      i. Use Table 2 – MINIMUM TEMPERATURE, DEGREES as guide:

| Table 2 – MINIMUM TEMPERATURE, DEGREES | | | | | | |
|---|---|---|---|---|---|---|
| Ambient Air Temperature Deg F. | Compacted Paving Mat Thickness | | | | | |
| | 3/4" (19 mm) | 1" (25 mm) | 1 1/2" (38 mm) | 2" (50 mm) | 3" (75 mm) | 4" + (100 mm) |
| 45 – 50 | --- | --- | --- | --- | 280 | 265 |
| 50 – 59 | --- | --- | --- | 280 | 270 | 255 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 60 – 69 | --- | --- | 285 | 275 | 265 | 250 |
| 70 – 79 | 285 | 285 | 280 | 270 | 265 | 250 |
| 80 - 89 | 280 | 275 | 270 | 265 | 260 | 250 |
| 90+ | 275 | 270 | 265 | 260 | 250 | 250 |

j. Longitudinal bituminous joints shall be vertical and properly tack coated if cold. Transverse joints shall always be tack coated.

2. Compaction:
   a. Compact asphalt paving to ninety-six (96) percent minimum of Marshall value. Determine percent compaction by ASTM D2950/D2950M.
      1) Alternate density and compaction:
         (a) Compact asphalt paving to ninety-four (94) percent of Maximum Theoretical Specific Gravity minimum plus three (3) percent and minus two (2) percent. Determine percent compaction by D2041/D2041M.
   b. Roll with powered equipment capable of obtaining specified density while providing required smoothness.
   c. Begin breakdown rolling immediately after asphalt is placed when asphalt temperature is at maximum:
   d. Complete handwork compaction concurrently with breakdown rolling.
   e. Execute compaction so visibility of joints is minimized:
   f. Complete finish rolling to improve asphalt surface as soon as possible after intermediate rolling and while asphalt paving is still warm.
   g. Do not use vibration for finish rolling.
3. Lift Thickness:
   a. Preferred Method:
      1) For pavements 3-1/2 inch or thinner apply asphalt paving in single lift.
      2) For pavements greater than 3-1/2 inch, use alternate method below.
   b. Alternate Method:
      1) Asphalt paving may be applied in two (2) lifts, first 2 inches thick minimum and second 1 1/2 inches thick minimum following temperature recommendations of following paragraph.
      2) Surface of first lift shall be clean and provide tack coat between first and second lifts.
      3) Provide not less than two (2) times maximum aggregate size in compacted asphalt concrete mixes.
         (a) Asphalt Paving Surface Treatments:

E. Apply mandatory Asphalt Paving Surface Treatment no sooner than thirty (30) days or no later than eighteen (18) months of placing Asphalt Paving to be included with this project. Do not apply prior to asphalt curing (refer to ‘Asphalt, Concrete and Pervious Concrete Maintenance Guidelines’):
   1. Asphalt Based Penetrating Seal as specified in Section 32 0113.01 ‘Asphalt Paving Surface Treatment: Asphalt Based Penetrating Seal’.
   2. Paint Stripes:
   3. Apply paint stripes after asphalt paving surface treatment has been applied to asphalt paving.

**3.04 FIELD QUALITY CONTROL**

A. Field Tests And Inspections:
   1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner’s independent Testing Agency as specified in Section 01 4523 ‘Testing And Inspection Services’:
      a. Quality Control is sole responsibility of Contractor:

1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
   (a) Testing and inspections will be responsibility of Contractor to be performed by an independent entity.
2) Contractor bears full responsible for compliance with all contract requirements and quality control on project and will be responsible for quality of asphalt mixture and asphalt installation.

B. Field Tests (Provided by Contractor):
   1. General:
      a. Contractor bears full responsibility for compliance with all contract requirements and quality control on project and will be responsible for quality of asphalt mixture and asphalt installation.
      b. Testing and Inspection Reports to be distributed as specified in Section 01 4523 'Testing And Inspection Services'.
   2. Compaction Tests:
      a. Contractor to provide compaction tests of asphalt being placed to establish rolling patterns and installation procedures.
      b. Compaction tests by Contractor are independent of compaction tests being provided by Owner. See Section 01 4523 'Testing And Inspection Services'.
      c. Compact asphalt paving to ninety-six (96) percent minimum of Marshall value. Determine percent compaction by ASTM D2041/D2041M:
         1) Alternate density and compaction:
            (a) Compacted to ninety-four (94) percent of Theoretical Maximum Specific Gravity (Rice) minimum plus three (3) percent and minus two (2) percent. Determine percent compaction by ASTM D2950/D2950M.
   3. Thickness Tests:
      a. Determine thickness of paving being placed, no less than one (1) test per 10,000 sq. ft. of paving or portion thereof, three (3) tests minimum.

C. Field Tests And Inspections (Provided by Owner):
   1. General:
      a. Compaction tests provided by Owner will be used to validate or determine discrepancies with testing by Contractor.
      b. Civil engineer applies pay factor for Gradation/Asphalt Content, In-Place Density. Civil engineer computes pay factor for each lot.
      c. Opening paved surface to traffic does not constitute acceptance.
      d. Unless required by the Owner's Representative, Testing Agency is to base compaction testing on the Contractor's submitted mix design for theoretical maximum specific gravity (Rice) or Marshall specific gravity (Bulk) values.
      e. Asphalt-aggregate mix sampling as per ASTM D979/D979M.
         1) Test for:
            (a) Air voids as per ASTM D3203/D3203M.
            (b) Asphalt binder content as per ASTM D6307.
            (c) Aggregate gradation as per ASTM D5444.
      f. Lot size: 10,000 sq. ft. or part thereof.
      g. Sub lot size: 5,000 sq. ft. or part thereof.
   2. At Site Testing and Inspection:
      a. Asphalt Paving:
         1) Testing Agency shall provide full time nuclear density testing and inspection for asphalt paving during asphalt paving operations (nuclear density testing is informational testing only and does not constitute acceptance by Owner).
         2) Inspection to include:
            (a) Aggregate coating.

(b) Compaction control and effort required.
(c) Suitability of spreading and asphalt paving equipment.
(d) Temperature of mix as delivered and placed.
(1) Reject mixes exceeding 325 deg F in transport vehicle as required in Non-Conforming Work below.
(2) Dispose of cold mix in paver hopper as thin spread underlay.

3) Field Tests:
(a) When tested with 10 foot straight edge, surface of completed work shall not contain irregularities in excess of 1/4 inch.
(b) Determine percent compaction per ASTM D2950/D2950M unless other nondestructive nonnuclear methods such as sonar are used.
(c) Provide written nuclear density testing, or other nondestructive nonnuclear methods such as sonar, of asphalt paving at minimum rate of one (1) per 2,500 sq. ft. Select test locations by ASTM D3665 and sample per ASTM D979/D979M before compaction. Minimum of three (3) tests required.
(d) Compact asphalt paving to ninety-six (96) percent minimum of Marshall/Bulk value. Determine percent compaction by ASTM D2950/D2950M:
(1) Alternate density and compaction:
(2) Compact asphalt paving to ninety-four (94) percent of Theoretical Maximum Specific Gravity (Rice) plus three (3) percent or minus two (2) percent. Determine percent compaction by ASTM D2041/D2041M.
(e) Maximum average total air voids in completed hot mix asphalt shall be eight (8) percent but more than three (3) percent as determined by ASTM D2041/D2041M.
(f) Determine thickness of paving being placed, no less than one (1) test per 10,000 sq. ft. of paving or portion thereof, three (3) tests minimum.

3. At Laboratory Testing:
a. General:
1) Provide at least one (1) laboratory test series for every 10,000 sq. ft. or part thereof (minimum of one (1) test):
(a) Test reports will show compliance with Contract Documents regarding type of aggregate base, depth of aggregate base, depth and density of asphalt paving, asphalt content, aggregate gradation, flow and stability, bulk specific gravity and maximum specific gravity.
(b) Reports will also give test procedures used by testing laboratory.

b. Compaction and Final Density:
1) Pavement thickness and final density to be determined by results of coring. Provide one (1) core per 10,000 sq. ft. or part thereof. Minimum of three (3) tests required if under 30,000 sq. ft.:
(a) Based upon core samples, compaction is acceptable if test deviations are within pay factor 1.00 limits.
(b) At Project Manager's discretion, after consulting with design team, a Lot with a sub-lot test deviation greater than Reject may stay in place at fifty (50) percent cost.
(c) Select test locations by ASTM D3665 and sample per ASTM D979/D979M after compaction.

c. Compaction Pay Factor:
1) Based upon core samples, compaction is acceptable if test deviations are within pay factor 1.00 limits.
2) At Project Manager's discretion, after consulting with design team, a Lot with a sub-lot test deviation greater than Reject may stay in place at fifty (50) percent cost.
3) Average Density, in percent as per Table 3 – COMPACTION PAY FACTORS:

| Table 3 – COMPACTION PAY FACTORMINIMUM TEMPERATURE DEGRE<br>(96 percent of laboratory required – Marshall Method ASTM D2726/D2726M) | |
|---|---|
| Actual Density percent<br>As Compared Marshall/Bulk Density | Pay Factor<br>Applied to Bid Asphalt Qualities |
| 96.0 | 100.0 |
| 95.9 | 99.7 |
| 95.8 | 99.3 |
| 95.7 | 98.9 |
| 95.6 | 98.4 |
| 95.5 | 97.8 |
| 95.4 | 97.1 |
| 95.3 | 96.4 |
| 95.2 | 95.8 |
| 95.1 | 94.6 |
| 95.0 | 93.4 |
| 94.9 | 92.2 |
| 94.8 | 90.7 |
| 94.7 | 89.1 |
| 94.6 | 87.8 |
| 94.5 | 85.1 |
| 94.4 | 82.6 |
| 94.3 | 79.5 |
| 94.2 | 75.5 |
| 94.1 | 69.7 |
| 94.0 | 60.0 |
| Under 94.0 | REJECT |

d. Average Density determined by alternate method as shown in following Table 4 – COMPACTION PAY FACTORS:

| Table 4 – COMPACTION PAY FACTORS<br>(94 percent of theoretical maximum specific gravity – Superpave (Rice)<br>(ASTM D2041/D2041M plus three (3) or minus two (2) percent) | | |
|---|---|---|
| Pay Factor | Density, in Percent | |
| | Average | Lowest Test |
| 0.70 | More than 96 | --- |
| 1.00 | 92 to 96 | 89 or Greater |
| 0.90 | 92 to 96 | Less than 89 |
| Reject | Less than 92 | --- |
| Notes:<br>1. At Contractor's discretion and expense, do Hamburg wheel track test (AASHTO T 304) on 3 additional random core samples from non-complying sub-lot of 5,000 sq. ft. Sub-lot will be accepted if average rut depth is less than 10 mm at 20,000 passes. | | |

e. Pavement Thickness:
   1) Pavement thickness and final density to be determined by results of coring. Provide one (1) core per 10,000 sq. ft. or part thereof. Minimum of three (3) tests required if under 30,000 sq. ft. .
      (a) Acceptance will be based on the average of all thickness tests.

(b) At Project Manager's discretion, after consulting with design team, payment may be made for areas deficient in thickness by more than 0.75 inches at fifty (50) percent. If not, remove and replace at no additional cost to the Owner in following Table 5 – THICKNESS PAY FACTORS:

| Table 5 – THICKNESS PAY FACTORS | |
|---|---|
| Pay Factors | Thickness Deficiency, in Inches (ASTM D3549/D3549M) |
| 1.00 | 0.00 to 0.25 |
| 0.90 | 0.26 to 0.50 |
| 0.70 | 0.51 to 0.75 |
| Reject | 0.76 to 1.00 |

f. Air Voids:
   1) Basis of evaluation is laboratory compacted samples (not field compacted samples).
   2) Air voids will be mix design target plus or minus one (1) percent.
   3) If test results are not within this Section's limits, options include correction of production procedures or alternate mix design acceptable to Civil Engineer.

D. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Asphalt Paving:
      a. Deficient asphalt paving thickness:
         1) Place additional material over deficient areas. Do not skin patch. Mill for inlay if necessary. Correct deficient asphalt paving thickness at no additional cost to the Owner.
      b. Rejection and Removal of Asphalt Paving:
         1) Remove asphalt paving found defective after installation and install acceptable product at no additional cost to the Owner.
      c. Removal of Asphalt Paving:
         1) Remove spatter, over-coat, or mar at no additional cost to the Owner.
         2) Remove asphalt from borrow pits or gutters at no additional cost to the Owner.
      d. Repair of Asphalt Paving:
         1) Repair or replace defective joints, seams, edges at no additional cost to the Owner.

**3.05 PROTECTION**

A. Tack Coat:
   1. Protect all surfaces exposed to public view from being spattered or marred. Remove any spattering, over-coating, or marring at no additional cost to Owner.
   2. Traffic:
      a. Do not permit traffic to travel over tacked surface until tack coat has cured and dried.

B. Asphalt Paving:
   1. Protect hot mixed asphalt (HMA) pavement from traffic until mixture has cooled enough not to become marked.

**3.06 CLEANING**

A. Waste Management:
   1. Pre-emergent herbicide:
      a. Follow Manufacturer's recommendations for disposal of product at approved waste disposal facility.
         1) Do not reuse empty containers.

**END OF SECTION**

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**SECTION 32 1216.04**
**ASPHALT PAVING - SUPERPAVE MIX**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install asphalt paving in driveways and parking areas as described in Contract Documents including the following, but not limited to:
   a. Asphalt Mix Design Criteria Summary:

| | | |
|---|---|---|
| 1) | Asphalt Binder: | PG 58-28 (or Binder locally used by DOT) |
| 2) | Nominal Maximum Size Aggregate (Nmas): | 3/8 inch (9.5 mm)(3/4 inch for base with 1-1/2 inch top layer acceptable) |
| 3) | Maximum Size Aggregate: | 1/2 inch (1 inch for base with 1-1/2" top layer acceptable) |
| 4) | Mix Designator (compaction effort); Ndesign: | 50 |
| 5) | Antistrip Agent: | If required by supplier's mix design (use 1 percent or greater lime slurry when required. |
| 6) | Asphalt Reinforcement Fibers: | Specified in Section 32 1217 as Alternate 'A' (not allowed in Welfare Services Projects) |
| | | Allowed up to 25 percent. Asphalt binder shall be one grade softer when more than 15 percent RAP is used. |
| 8) | ROSP: | Not allowed. |
| 9) | Mineral Filler: | Not allowed. |
| 10) | Warm Mix Additive: | If required by supplier's mix design. |
| 11) | Recycle Agent: | If required by supplier's mix design. |

   b. Design Air Voids:
      1) Three and one-half percent (3.5 percent).
   c. Tack coat: Application of asphaltic material to existing asphalt concrete or Portland concrete surfaces before asphalt concrete pavement.
   d. Blotter materials and procedures for absorbing excess asphalt as required.

B. Related Requirements:

1. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
2. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
3. Section 31 0500: 'Common Earthwork Requirements' for:
   a. General procedures and requirements for earthwork.
   b. Pre-installation conference held jointly with other common earthwork related sections.
4. Section 31 2323: 'Fill and Aggregate Base' for compaction of aggregate base.
5. Section 31 2323: 'Fill and Aggregate Base' for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
6. Section 31 2323: 'Fill and Aggregate Base' for grading of subgrade below aggregate base and topsoil.

7. Section 31 2323: 'Fill and Aggregate Base' for compaction procedures and tolerances.
8. Section 32 0113.01: 'Asphalt Paving Surface Treatment: Penetrating Seal'.
9. Section 32 1717: 'Asphalt Reinforcement Fibers'.
10. Section 32 1723: 'Pavement Markings'.

## 1.02 PRICE AND PAYMENT PROCEDURES

A. Alternates:
1. Asphalt Reinforcement Fibers are bid as Alternate 'A' as specified in Price and Payment Procedures in Part 1 of Section 32 1216. Owner's Representative will review bid and decide if asphalt reinforcing fibers will be included in Project.

## 1.03 REFERENCES

A. Association Publications:
1. Asphalt Institute, 2696 Research Park Dr., Lexington, KY www.asphaltinstitute.org:
a. MS-2, 'Mix Design Methods' (7th Edition 2015).

B. Definitions:
1. Aggregate: Hard inert mineral material, such as gravel, crushed rock, slag, or sand.
a. Coarse Aggregate: Aggregate retained on or above No. 4 sieve.
b. Coarse-Graded Aggregate: Aggregate having predominance of coarse sizes.
c. Dense-Graded Aggregate: Aggregate that is graded from maximum size down through filler with object of obtaining an asphalt mix with controlled void content and high stability.
d. Fine Aggregate: Aggregate passing No. 4 sieve.
e. Fine-Graded Aggregate: Aggregate having predominance of fine sizes.
f. Mineral Filler: Fine mineral product at least 70 percent of which passes a No. 200 sieve.
2. Air Voids: Total volume of small air pockets between coated aggregate particles in asphalt cement concrete (ACC); expressed as percentage of bulk volume of compacted paving mixture.
3. Anti-Stripping Agent: Chemicals added to bitumen to improve the adhesion of the bitumen to hydrophilic aggregates
4. Asphalt Binder: Asphalt cement or modified asphalt cement that binds aggregate particles into dense mass.
a. Asphalt Cement used in paving applications that has been classified according to the Standard Specification for Performance Graded Asphalt Binder, AASHTO Designation MP 320. It can be either unmodified or modified Asphalt Cement, as long as it complies with specifications.
5. Asphalt-Aggregate Designator: Alpha-numeric code that indicates nominal maximum size of aggregate, and type and grade of asphalt in aggregate-asphalt mix.
a. Example: "12.5 PG70-28" means aggregate asphalt mix shall be composed of aggregate gradation with 12.5 mm (1/2 inch) nominal maximum size and performance grade asphalt binder designed to perform between temperatures of 70 deg C and -28 deg C (158 deg F and -18.4 deg F).
6. Equivalent Single Axle Load (ESAL): Effect on pavement performance of any combination of axle loads of varying magnitude equated to number of 18,000-lb. single-axle loads that are required to produce an equivalent effect.
7. Maximum Size (Superpave): One sieve larger than the nominal maximum size.
8. Ndesign (Superpave): Design number of gyrations used for design of Hot Mix Asphalt (HMA).
9. Nominal Maximum Size: One sieve size larger than first sieve size retaining more than 10 percent of Sample. Nominal maximum size sieve will retain minimum of 0 and maximum of 10 percent of sample. Maximum size is one sieve size larger than nominal maximum size.
10. Performance Graded Asphalt Binder (PGAB): Asphalt binder designed to produce HMA that meets certain performance standards. Designations for performance-graded asphalt

binders are prefixed with PG. Each grade designation also includes two sets of numbers that denote temperature range. This is a range of climate temperatures to which road may be exposed and still be expected to give superior performance. PG numbers do not indicate viscosity as in conventional liquid asphalt designations.

11. Pre-emergent Herbicide: Chemical that is applied before weeds emerge. It acts by killing weed seedlings and /or establishing layer of chemical on or near soil surface that is toxic to germinating seeds and young seedlings.
12. Reclaimed Asphalt Pavement (RAP): Existing asphalt mixture that has been pulverized, usually by milling, and is used like aggregate in recycling of asphalt pavements.
13. Subgrade (definition varies depending upon stage of construction and context of work being performed):
    a. Prepared natural soils on which fill, aggregate base, or topsoil is placed.
    b. OR
    c. Prepared soils immediately beneath paving.
14. Tack Coat: Very light application of liquid asphalt, or asphalt emulsion diluted with water.

C. Reference Standards:
1. American Association of State and Highway Transportation Officials:
    a. AASHTO T 304-17: ‘Standard Method of Test for Uncompacted Void Content of Fine Aggregate’.
    b. AASHTO T 322-07(2016), ‘Standard Method of Test for Determining the Creep Compliance and Strength of Hot-Mix Asphalt (HMA) Using the Indirect Tensile Test Device.
2. ASTM International:
    a. ASTM C29/C29M-17a, ‘Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate'.
    b. ASTM C88-13, ‘Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate'.
    c. ASTM C117-17, ‘Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing'.
    d. ASTM C131/C131M-14, 'Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine’.
    e. ASTM C142/C142M-17, ‘Standard Test Method for Clay Lumps and Friable Particles in Aggregates'.
    f. ASTM D242/D242M-09(2014), ‘Standard Specification for Mineral Filler For Bituminous Paving Mixtures'.
    g. ASTM D977-17, 'Standard Specification for Emulsified Asphalt’.
    h. ASTM D979/D979M-15, 'Practice for Sampling Bituminous Paving Mixtures'.
    i. ASTM D2041/D2041M-11, 'Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures’.
    j. ASTM D2172/D2172M-17, ‘Standard Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures’.
    k. ASTM D2256/ D2256M-10(2015), ‘Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method’.
    l. ASTM D2397/D2397M-17, 'Standard Specification for Cationic-Emulsified Asphalt’.
    m. ASTM D2419-14, ‘Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate'.
    n. ASTM D2950/D2950M-17, ‘Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods'.
    o. ASTM D3203/D3203M-11, ‘Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures'.
    p. ASTM D3549/D3549M-17, ‘Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens’.
    q. ASTM D3665-12(2017), ‘Standard Practice for Random Sampling of Construction Materials’.

r. ASTM D4318-17, ‘Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils'.
s. ASTM D4552/D4552M-10(2016), ‘Standard Practice for Classifying Hot-Mix Recycling Agents'.
t. ASTM D4759-11(2018), ‘Standard Practice for Determining the Specification Conformance of Geosynthetics'.
u. ASTM D4791-10, ‘Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
v. ASTM D5444-15, ‘Standard Method for Mechanical Size Analysis of Extracted Aggregate'.
w. ASTM D5821-13(2017), ‘Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate’.
x. ASTM D6307-16, ‘Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method'.
y. ASTM D6932/D6932M-08(2013), ‘Standard Guide for Materials and Construction of Open-Graded Friction Course Plant Mixtures’.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
1. Participate in MANDATORY pre-installation conference as specified in Section 31 0500 ‘Common Earthwork Requirements’:
2. In addition to agenda items specified in Section 01 3100 ‘Project Management and Coordination’ and Section 31 0500 ‘Common Earthwork Requirements’, review following:
a. Review surveying and staking of parking areas and installation of sleeves.
b. Review proposed aggregate base schedule.
c. Review rough grading elevations before placing paving fill.
d. Review fine grading elevations of subgrade fine grading operations before placing aggregate base and paving.
e. Review proposed asphalt paving schedule.
f. Review asphalt paving mix design.
g. Review pre-emergent herbicide protection of adjoining property and planting area on site requirements, schedule and application requirements.
h. Review schedule of mandatory asphalt paving surface treatment to be applied after placement of asphalt paving.
i. Review schedule of paint stripes to be applied after asphalt paving surface treatment.
j. Review safety issues.
k. Review Section 01 4523 ‘Testing and Inspecting Services’ for administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
1) Review requirements and frequency of testing and inspections.
2) Review Contractor Testing Agency Qualifications.

B. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing asphalt paving.

## 1.05 SUBMITTALS

A. Action Submittals:
1. Product Data:
a. Pre-Emergent Herbicide:
1) Manufacturer's published product data on pre-emergent herbicide.

B. Informational Submittals:
1. Certificates:
a. Require mix plant to furnish delivery/load tickets for each batch of asphalt. Keep delivery tickets at job-site for use of Owner’s Representative. Tickets shall show following:

1) Name of mix plant.
2) Date
3) Name of contractor.
4) Name and location of Project.
5) Serial number of ticket.
6) Asphalt mix type.
7) Time loaded.
8) Identity of truck.

b. Installer to provide Manufacturer's Certificate of Compliance stating material authenticity and properties for review and acceptance by Architect before product use.

2. Design Data:
   a. Hot Mix Asphalt:
      1) Design Criteria:
         (a) Develop mix design according to current Asphalt Institute MS-2 'Asphalt Mix Design Methods' for Superpave Method.
         (b) Submittal format:
            (1) Design mix submittal shall follow format as indicated in current Asphalt Institute MS-2, 'Mix Design Methods.
      2) Mix design of asphalt paving must meet Design Criteria minimum requirements and show conformance to the following:
         (a) Location and name of hot mix asphalt concrete production facility.
         (b) Date of mix design. If older than two (2) years, recertify mix design.
         (c) Asphalt mix type.
         (d) Mix design method used.
         (e) Mix density.
         (f) Design air voids (three and one half (3.5) percent.
         (g) Asphalt content in percent.
         (h) Performance grade of asphalt binder.
         (i) Nominal maximum size of aggregate.
         (j) Maximum size of aggregate.
         (k) Aggregate source and gradation.
         (l) Mix properties and design parameters.
         (m) Temperature of mix at plant and in the field for optimum field compaction.
         (n) Amount of recycled asphalt pavement (RAP).
         (o) Mineral fillers, antistrip, and recycle agent percentages.
         (p) Identify if warm mix technologies will be used and how much warm mix additive will be used.
      3) Within thirty (30) days prior to asphalt construction, submit actual design mix to Architect, Civil Engineering Consultant of Record and Independent Testing Laboratory for review and approval.
3. Test And Evaluation Reports:
   a. Hot Mix Asphalt:
   b. Contractor's Testing Agency copies of Field Test results to show compliance with all contract requirements and quality control for quality of asphalt mixture and asphalt installation.
   c. Owner's Testing Agency copies of Field Tests and Inspections used to validate or determine discrepancies with testing by Contractor.
4. Manufacturer Instructions:
   a. Pre-Emergent Herbicide:
      1) Application instructions for pre-emergent herbicide.
   b. Qualification Statement:
      1) Installer:

(a) Provide Qualification documentation if requested by Owner's Representative.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800 'Closeout Submittals':
a. Record Documentation:
1) Manufacturer's documentation:
(a) Pre-emergent herbicide documentation.
(b) Asphalt paving design.
(c) Test reports.
(d) Certificates from mix plant of delivery/load tickets.
(e) Manufacturer's Certificate of Compliance.
2) Testing and Inspection Reports:
(a) Testing Agency Testing and Inspecting Reports of asphalt paving.

## 1.06 QUALITY ASSURANCE

A. Qualifications. Requirements of Section 01 4301 'Quality Assurance - Qualifications' applies but not limited to following:
1. Asphalt Paving:
a. Foreman of asphalt paving crew has completed at least three (3) projects of similar size and nature.
b. Upon request, submit documentation.
2. Pre-emergent herbicide:
a. Applicator:
1) Pre-emergent herbicide shall be applied by applicator certified by State in which Project is located as an applicator of agricultural chemicals.

B. Testing and Inspection:
1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
2. Owner will provide Testing and Inspection for asphalt paving:
a. Owner will employ testing agencies to perform testing and inspection for asphalt paving as specified in Field Quality Control in Part 3 of this specification.
1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
2) See Section 01 1200: 'Multiple Contract Summary'.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Asphalt Material:
a. Each shipment must:
1) Be uniform in appearance and consistency.
2) Show no foaming when heated to specified loading temperature.
b. Do not supply shipments contaminated with other asphalt types or grades than those specified:
1) Do not use petroleum distillate as a release agent.
2. Pre-emergent herbicide:
a. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
1. Pre-emergent herbicide:
a. Do not freeze. Store in at temperatures above 41 deg F .
b. Follow Manufacturer's storage and handling requirements.

## 1.08 FIELD CONDITIONS

A. Ambient Conditions:
   1. Pre-emergent herbicide:
      a. Follow printed Manufacturers instruction for environmental hazards:
      b. Follow printed Manufacturers instruction ambient conditions for application of product.
   2. Tack Coat:
      a. Apply only when air and roadbed temperatures in shade are greater than 40 deg F . Temperature restrictions may be waived only upon written authorization from Architect or Civil Engineer.
      b. Do not apply to wet surfaces.
      c. Do not apply when weather conditions prevent tack coat from adhering properly.
   3. Asphalt paving:
      a. Do not perform work during following conditions:
         1) Ambient temperature is below 45 deg F or will fall below 45 deg F during placement.
         2) Temperature of aggregate base below 50 deg F.
         3) Cold Weather Asphalt Paving Plan: If asphalt pavement is placed outside of these temperature limits or those identified in MINIMUM Temperature Degrees, a plan is required which includes:
            (a) Haul times.
            (b) Placement details.
            (c) Compaction aids used in production.
            (d) Owner does not assume responsibility for asphalt when placed outside temperature limits.
         4) Presence of free surface water or weather is unsuitable.
         5) Wind or ground cools mix material before compaction.

# PART 2 PRODUCTS

## 2.01 DESIGN CRITERIA

A. General:
   1. Follow current Asphalt Institute MS-2 ‘Asphalt Mix Design Methods’ for Superpave Method.

B. Asphalt Mix:
   1. Asphalt Binder:
      a. Performance Graded Asphalt Binder:
         1) Use performance graded asphalt binder identified under Asphalt Mix Design Criteria.
   2. Aggregates:
      a. Use clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.
      b. Use nominal maximum size aggregate and maximum size aggregate per Asphalt Mix Design Criteria. Aggregate gradation to meet Table 1 - MASTER GRADING BANDS requirements:

| Table 1 - MASTER GRADING BANDS | | | |
|---|---|---|---|
| Sieve (mm) | | Nominal Maximum Aggregate Size | |
| | | 12.5 mm | 9.5 mm |
| Control Sieves | 19 | 100 | - |
| | 12.5 | 100 | 100 |
| | 9.5 | < 90 | 90 – 100 |
| | 4.75 | -- | < 90 |
| | 2.36 | 28 – 58 | 32 – 60 |

| | | | |
|---|---|---|---|
| | 0.075 | 2 – 10 | 2 – 10 |
| Restricted Zone | 2.36 | 39.1 | 47.2 |
| | 1.18 | 25.6 – 31.6 | 31.6 – 37.6 |
| | 0.6 | 19.1 – 23.1 | 23.5 – 27.5 |
| | 0.3 | 15.5 | 18.7 |

NOTES:
1. It is assumed fine and coarse aggregate have same bulk specific gravity.
2. Gradation is expressed in percent passing by weight, ASTM C136. Percentage of fines passing 0.075 mm control sieve determined by washing, ASTM C117.

c. Provide aggregate material properties to meet Table 2 – AGGREGATE PHYSICAL PROPERTIES requirements:

| Table 2 –AGGREGATE PHYSICAL PROPERTIES | | | | | |
|---|---|---|---|---|---|
| Property | | ASTM | ESAL | Min | Max |
| Coarse Aggregate (does not pass No. 4 sieve) | | | | | |
| Angularity (fractured faces), percent | | D5821 | less than 0.3 | 55 | -- |
| | | | 0.3 to 3.0 | 75 | -- |
| | | | greater than 3.0 | 85/80 | -- |
| Wear (hardness or toughness), percent | | C131/C131M | less than 0.3 | -- | 40 |
| | | | 0.3 to 3.0 | -- | 35 |
| | | | greater than 3.0 | -- | 35 |
| Flats or elongates (3:1 length to width), percent, maximum | | D4791 | -- | -- | 20 |
| Fine Aggregate (passing No. 4 sieve) | | | | | |
| Angularity (uncompacted void content), percent (AASHTO T304) | | -- | less than 0.3 | -- | -- |
| | | | 0.3 to 3.0 | 40 | -- |
| | | | greater than 3.0 | 45 | -- |
| Sand equivalent, percent | | D2419 | less than 0.3 | 40 | -- |
| | | | 0.3 to 3.0 | 40 | -- |
| | | | greater than 3.0 | 45 | -- |
| Friable particles, percent | | C142 | -- | -- | 2 |
| Plastic limit, maximum | Liquid limit | D4318 | -- | -- | 25 |
| | Plastic limit | D4318 | -- | -- | 6 |

Notes:
1. ESAL in millions.
2. Angularity by weight retained above 9 mm sieve, with at least one fractured face. 85/80 denotes 85 percent coarse aggregate has one fractured face and 80 percent has two or more fractured faces.
3. Wear of aggregate retained above 2.36 mm sieve unless specific aggregates have higher values are known to be satisfactory.
4. Flats or elongates retained above 4.75 mm sieve.
5. Friable particles passing No. 4.75 mm sieve.
6. Plasticity, passing No. 4.75 sieve. Aggregate is no-plastic even when filler material is added to aggregate.

| Blended Physical Properties | | |
|---|---|---|

| | | | | |
|---|---|---|---|---|
| Dry-rodded unit weight, lb/ft3, minimum | C29/C29M | - | 75 | -- |
| Weight loss (soundness), percent, maximum | C88 | | -- | 16 |
| Clay content or cleanliness (sand equivalent), percent | D2419 | less than 0.3 | 45 | -- |
| | | more than 0.3 | 60 | -- |
| Notes:<br>1. Weight loss using sodium sulfate.<br>2. Sand equivalent value is after going through dryer or before drum mixer. The sand equivalent requirement is waived for RAP aggregate but applies to remainder of aggregate blend.<br>3. Friable particles of clay lumps, shale, wood, mica, and coal passing 4.75 sieve. | | | | |

3. Admixture:
   a. Antistrip: Heat stable, cement slurry, lime slurry, dry lime, or liquid antistrip:
      1) Add if mix is moisture sensitive as determined by 'Moisture Susceptibility' paragraph below.
   b. Mineral Filler: Comply with requirements of ASTM D242/D242M.
   c. Recycle Agent: Comply with requirements of ASTM D4552/D4552M.

**2.02 MATERIAL**

A. Aggregate Base: Conform to applicable requirements as specified in Section 31 2323: 'Fill and Aggregate Base'.

B. Asphalt Paving Surface Treatment:
   1. Include mandatory Asphalt Paving Surface Treatment to be applied no sooner than thirty (30) days or no later than eighteen (18) months of placing Asphalt Paving to be included with this project:
      a. Asphalt Based Penetrating Seal as specified in Section 32 0113.01 'Asphalt Paving Surface Treatment: Asphalt Based Penetrating Seal'.

C. Pre-Emergent Herbicide:
   1. Design Criteria:
      a. Selective type pre-emergence control chemical containing twenty-five (25 percent) Prometon minimum for control of annual grasses and broadleaf weeds.
      b. Non-oil based sterilant.
      c. Labeled for under-pavement use.
   2. Type Two Acceptable Products:
      a. Pramitol 25E Herbicide by WinField United, St Paul MN www.winfieldunited.com.
         1) Apply at a rate of 10 gal per 1 acre) conforming to application rates indicated on product label.
      b. Equal as approved by Architect before installation. See Section 01 6200.

D. Reclaimed Asphalt Pavement (RAP). Aggregate: Restrictions include:
   1. Allowed up to 25 percent. Asphalt binder shall be one grade softer when more than 15 percent RAP is used.

E. Tack Coat:
   1. Emulsified asphalt meeting requirements of ASTM D977, Grade SS-1H, CQS-1H, or ASTM D2397/D2397M, Grade CSS-1H.

**PART 3 EXECUTION**

**3.01 INSTALLERS**

A. Approved Applicators. See Section 01 4301 'Quality Assurance - Qualifications':

**3.02 PREPARATION**

A. General:
   1. Aggregate base and paving must be placed before any moisture or seasonal changes occur to subgrade that would cause compaction tests previously performed to be erroneous. Re-compact and retest subgrade soils that have been left exposed to weather.

B. Protection Of In-Place Conditions:
   1. Pre-emergent herbicide:
      a. Take necessary precautions to protect adjoining property and areas designated for planting on building site.
      b. Do not contaminate any body of water by direct application, cleaning of equipment or disposal of wastes.
   2. Asphalt Paving:
      a. Protect all structures, including curb, gutter, sidewalks, guard rails and guide posts.
      b. Protect neighborhood, storm drains and down-stream fish habitat.

C. Surface Preparation:
   1. Survey and stake parking surfaces to show grading required by Contract Documents.
   2. Subgrade (soil below aggregate base):
      a. Prepare natural, or fill, soil subgrade as specified in Section 31 2323 - Fill and Aggregate Base.
   3. Aggregate base:
      a. Finish grade parking surface area to grades required by Contract Documents.
      b. Compact aggregate base as specified in Section 31 2323 ‘Fill and Aggregate Base’.
      c. Tolerances:
         1) Elevation of aggregate base shall be as specified in Section 31 2323 - Fill and Aggregate Base.
   4. Tack coat:
      a. Clean surface of all materials such as mud, dirt, leaves, etc. that prevent tack from bonding to existing surfaces.
         1) If flushed, allow surface to dry.
   5. Asphalt paving:
      a. Area shall be clean and tack coat applied before placing of asphalt paving.
         1) Remove all moisture, dirt, sand, leaves, and other objectionable material from prepared surface before placing asphalt.
         2) Locate, reference, and protect all utility covers, monuments, curb, and gutter and other components affected by asphalt paving operations.
         3) Allow sufficient cure time for tack coat before placing asphalt.

**3.03 APPLICATION**

A. Interface With Other Work:
   1. Section 31 2323: ‘Fill and Aggregate Base’ for compaction of aggregate base.
   2. Section 31 2323: ‘Fill and Aggregate Base' for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
   3. Section 31 2323: ‘Fill and Aggregate Base' for grading of subgrade below aggregate base and topsoil.
   4. Section 31 2323: ‘Fill and Aggregate Base’ for compaction procedures and tolerances.

B. Pre-Emergent Herbicide:
   1. Asphalt paving areas:
      a. Follow Manufacturer’s printed application requirements:
      b. Apply to prepared subgrade dispersed in liquid. Concentrate shall be such that Manufacturer's full recommended amount of chemical will be applied to every 1000 sq ft and liquid will penetrate minimum of 2 inches.
      c. Application shall be no more than one (1) day before installation of aggregate base.

C. Tack Coat:
   1. General:

a. Tack coat vertical surfaces or existing asphalt cement concrete or portland cement concrete that will be in contact with asphalt paving.
b. Use tack coat diluted to a 2:1 (concentrate water) ratio.
c. Use pressure distributor to apply in uniform, continuous spread.
d. Cover all tacked surface areas with surfacing materials same day of application.

2. Application rate. Typically, as follows:
a. Emulsions, 0.08 to 0.15 gallons per sq yd of diluted material:
1) Apply sufficient to achieve ninety-five (95) percent or better coverage of existing surfaces.
2) Above application rates may vary according to field conditions. Obtain approval from Civil Engineer for quantities, rate of application, temperatures, and areas to be treated before any application.

D. Asphalt Paving:
1. General:
a. Paving adjacent to cast-in-place concrete site elements shall be between 1/4 inch higher than concrete.
b. Surface texture of hand worked areas shall match texture of machine-laid areas.
c. Surface shall be uniform with no 'birdbaths'. Leave finished surfaces clean and smooth. Variations from specified grades shall not exceed 1/2 inch .
d. Cross Slope: 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.
e. Grade: 1/8 inch in 10 feet parallel to centerline.
f. Do not place on frozen aggregate base or during adverse climatic conditions such as precipitation or when roadway surface is icy or wet.
g. Uniformly mix materials so aggregate is thoroughly coated with asphalt.
h. Place at temperatures established by the mix design with self-propelled laydown machine.
i. Use Table 3 – MINIMUM TEMPERATURE, DEGREES as guide:

Table 3 – MINIMUM TEMPERATURE, DEGREES

| Ambient Air Temperature Deg F. | Compacted Paving Mat Thickness 3/4" (19 mm) | 1" (25 mm) | 1 1/2" (38 mm) | 2" (50 mm) | 3" (75 mm) | 4" + (100 mm) |
|---|---|---|---|---|---|---|
| 45 – 50 | --- | --- | --- | --- | 280 | 265 |
| 50 – 59 | --- | --- | --- | 280 | 270 | 255 |
| 60 – 69 | --- | --- | 285 | 275 | 265 | 250 |
| 70 – 79 | 285 | 285 | 280 | 270 | 265 | 250 |
| 80 - 89 | 280 | 275 | 270 | 265 | 260 | 250 |
| 90+ | 275 | 270 | 265 | 260 | 250 | 250 |

j. Longitudinal bituminous joints shall be vertical and properly tack coated if cold. Transverse joints shall always be tack coated.

2. Compaction:
a. Compact asphalt paving to ninety-four (94) percent plus or minus two (2) percent of theoretical maximum specific gravity, ASTM D2041/D2041M (Rice Method - maximum theoretical density).
b. Roll with powered equipment capable of obtaining specified density while providing required smoothness.
c. Begin breakdown rolling immediately after asphalt is placed when asphalt temperature is at maximum.
d. Complete handwork compaction concurrently with breakdown rolling.
e. Execute compaction so visibility of joints is minimized:

f. Complete finish rolling to improve asphalt surface as soon as possible after intermediate rolling and while asphalt paving is still warm.
g. Do not use vibration for finish rolling.

3. Lift Thickness:
   a. Preferred Method:
      1) For pavements 3-1/2 inch or thinner apply asphalt paving in single lift.
      2) For pavements greater than 3-1/2 inch, use alternate method below.
   b. Alternate Method:
      1) Asphalt paving may be applied in two (2) lifts, first 2 inches thick minimum and second 1 1/2 inches thick minimum following temperature recommendations of following paragraph.
      2) Surface of first lift shall be clean and provide tack coat between first and second lifts.
      3) Provide not less than two (2) times maximum aggregate size in compacted asphalt concrete mixes.

E. Asphalt Paving Surface Treatments:
1. Apply mandatory Asphalt Paving Surface Treatment no sooner than thirty (30) days or no later than eighteen (18) months of placing Asphalt Paving to be included with this project. Do not apply prior to asphalt curing (refer to 'Asphalt, Concrete and Pervious Concrete Maintenance Guidelines'):
   a. Asphalt Based Penetrating Seal as specified in Section 32 0113.01 'Asphalt Paving Surface Treatment: Asphalt Based Penetrating Seal'.

F. Paint Stripes:
1. Apply paint stripes after asphalt paving surface treatment has been applied to asphalt paving.

**3.04 FIELD QUALITY CONTROL**

A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
   a. Quality Control is sole responsibility of Contractor:
      1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
         (a) Testing and inspections will be responsibility of Contractor to be performed by an independent entity.
      2) Contractor bears full responsible for compliance with all contract requirements and quality control on project and will be responsible for quality of asphalt mixture and asphalt installation.

B. Field Tests (Provided by Contractor):
1. General:
   a. Contractor bears full responsibility for compliance with all contract requirements and quality control on project and will be responsible for quality of asphalt mixture and asphalt installation.
   b. Testing and Inspection Reports to be distributed as specified in Section 01 4523 'Testing And Inspection Services'.
2. Compaction Tests:
   a. Contractor to provide compaction tests of asphalt being placed to establish rolling patterns and installation procedures.
   b. Compaction tests by Contractor are independent of compaction tests being provided by Owner. See Section 01 4523 'Testing And Inspection Services'.

c. Asphalt paving shall be compacted to ninety-four (94) percent of Theoretical Maximum Specific Gravity (Rice) plus three (3) percent or minus two (2) percent. Determine percent compaction by ASTM D2041/D2041M.

3. Thickness Tests:
   a. Determine thickness of paving being placed, no less than one (1) test per 10,000 sq. ft. of paving or portion thereof, three (3) tests minimum.

C. Field Tests And Inspections (Provided by Owner):
1. General:
   a. Compaction tests provided by Owner will be used to validate or determine discrepancies with testing by Contractor.
   b. Civil engineer applies pay factor for Gradation/Asphalt Content, In-Place Density. Civil engineer computes pay factor for each lot.
   c. Opening paved surface to traffic does not constitute acceptance.
   d. Unless required by the Owner's Representative, Testing Agency is to base compaction testing on Contractor's submitted mix design for theoretical maximum specific gravity (Rice) or Marshall specific gravity (Bulk) values.
   e. Asphalt-aggregate mix sampling as per ASTM D979/D979M.
      1) Test for:
         (a) Air voids as per ASTM D3203/D3203M.
         (b) Asphalt binder content as per ASTM D6307.
         (c) Aggregate gradation as per ASTM D5444.
   f. Lot size: 10,000 sq. ft. or part thereof.
   g. Sub lot size: 5,000 sq. ft. or part thereof.
2. At Site Testing and Inspection:
   a. Asphalt Paving:
      1) Testing Agency shall provide full time nuclear density testing and inspection for asphalt paving during asphalt paving operations (nuclear density testing is informational testing only and does not constitute acceptance by Owner).
      2) Inspection to include:
         (a) Aggregate coating.
         (b) Compaction control and effort required.
         (c) Suitability of spreading and asphalt paving equipment.
         (d) Temperature of mix as delivered and placed.
            (1) Reject mixes exceeding 325 deg F in transport vehicle as required in Non-Conforming Work below.
            (2) Dispose of cold mix in paver hopper as thin spread underlay.
      3) Field Tests:
         (a) When tested with 10 foot straight edge, surface of completed work shall not contain irregularities in excess of 1/4 inch.
         (b) Determine percent compaction per ASTM D2950/D2950M unless other nondestructive nonnuclear methods such as sonar are used.
         (c) Provide written nuclear density testing, or other nondestructive nonnuclear methods such as sonar, of asphalt paving at minimum rate of one (1) per 2,500 sq. ft. (232 sq. m). Select test locations by ASTM D3665 and sample per ASTM D979/D979M before compaction. Minimum of three (3) tests required.
         (d) Compact asphalt paving to ninety-four (94) percent of Theoretical Maximum Specific Gravity (Rice) plus three (3) percent or minus two (2) percent.
         (e) Maximum average total air voids in completed hot mix asphalt shall be eight (8) percent but more than three (3) percent as determined by ASTM D2041/D2041M.
         (f) Determine thickness of paving being placed, no less than one (1) test per 10,000 sq. ft. of paving or portion thereof, three (3) tests minimum.
3. At Laboratory Testing:

a. General:
   1) Provide at least one (1) laboratory test series for every 10,000 sq. ft. (930 sq. m) or part thereof (minimum of one (1) test):
      (a) Test reports will show compliance with Contract Documents regarding type and depth of aggregate base, depth and density of asphalt paving, asphalt content, aggregate gradation, flow and stability, bulk specific gravity and maximum specific gravity.
      (b) Reports will also give test procedures used by testing laboratory.

b. Compaction and Final Density:
   1) Pavement thickness and final density to be determined by results of coring. Provide one (1) core per 10,000 sq. ft. or part thereof. Minimum of three (3) tests required if under 30,000 sq. ft. .
      (a) Based upon core samples, compaction is acceptable if test deviations are within pay factor 1.00 limits.
      (b) At Project Manager's discretion, after consulting with Design Team, a Lot with a sub-lot test deviation greater than Reject may stay in place at fifty (50) percent cost.
      (c) Select test locations by ASTM D3665 and sample per ASTM D979/D979M after compaction.

c. Compaction Pay Factor:
   1) Based upon core samples, compaction is acceptable if test deviations are within pay factor 1.00 limits.
   2) At Project Manager's discretion, after consulting with design team, a Lot with a sub-lot test deviation greater than Reject may stay in place at fifty (50) percent cost.
   3) Average Density, in percent as shown in Table 4 – COMPACTION PAY FACTORS:

Table 4 – COMPACTION PAY FACTORS
(94 percent of theoretical maximum specific gravity – Superpave (Rice)
(ASTM D2041/D2041M plus three (3) or minus two (2) percent)

| Pay Factor | Density, in Percent | |
|---|---|---|
| | Average | Lowest Test |
| 0.70 | More than 96 | --- |
| 1.00 | 92 to 96 | 89 or Greater |
| 0.90 | 92 to 96 | Less than 89 |
| Reject | Less than 92 | --- |

Notes:
1. At Contractor's discretion and expense, do Hamburg wheel track test (AASHTO T 304) on 3 additional random core samples from non-complying sub-lot of 5,000 sq. ft. Sub-lot will be accepted if average rut depth is less than 10 mm at 20,000 passes.

d. Pavement Thickness:
   1) Pavement thickness and final density to be determined by results of coring. Provide one (1) core per 10,000 sq. ft. or part thereof. Minimum of three (3) tests required if under 30,000 sq. ft.
      (a) Acceptance will be based on the average of all thickness tests.
      (b) At Project Manager's discretion, after consulting with design team, payment may be made for areas deficient in thickness by more than 0.75 inches at fifty (50) percent. If not, remove and replace at no additional cost to the Owner as shown in Table 5 – THICKNESS PAY FACTORS:

Table 5 – THICKNESS PAY FACTORS

| Pay Factors | Thickness Deficiency, in Inches (ASTM D3549/D3549M) |
|---|---|
| 1.00 | 0.00 to 0.25 |
| 0.90 | 0.26 to 0.50 |
| 0.70 | 0.51 to 0.75 |
| Reject | 0.76 to 1.00 |

e. Air Voids:
   1) Basis of evaluation is laboratory compacted samples (not field compacted samples).
   2) Air voids will be mix design target plus or minus one (1) percent.
   3) If test results are not within this Section's limits, options include correction of production procedures or alternate mix design acceptable to Civil Engineer.

D. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Asphalt Paving:
      a. Deficient asphalt paving thickness:
         1) Place additional material over deficient areas. Do not skin patch. Mill for inlay if necessary. Correct deficient asphalt paving thickness at no additional cost to the Owner.
      b. Rejection and Removal of Asphalt Paving:
         1) Remove asphalt paving found defective after installation and install acceptable product at no additional cost to the Owner.
      c. Removal of Asphalt Paving:
         1) Remove spatter, over-coat, or mar at no additional cost to the Owner.
         2) Remove asphalt from borrow pits or gutters at no additional cost to the Owner.
      d. Repair of Asphalt Paving:
         1) Repair or replace defective joints, seams, edges at no additional cost to the Owner.

**3.05 PROTECTION**

A. Tack Coat:
   1. Protect all surfaces exposed to public view from being spattered or marred. Remove any spattering, over-coating, or marring at no additional cost to Owner.
   2. Traffic:
      a. Do not permit traffic to travel over tacked surface until tack coat has cured and dried.

B. Asphalt Paving:
   1. Protect hot mixed asphalt (HMA) pavement from traffic until mixture has cooled enough not to become marked.

**3.06 CLEANING**

A. Waste Management:
   1. Pre-emergent herbicide:
      a. Follow Manufacturer's recommendations for disposal of product at approved waste disposal facility.
         1) Do not reuse empty containers.

**END OF SECTION**

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**SECTION 32 1217**
**ASPHALT REINFORCEMENT FIBERS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install materials and equipment for mixing Asphalt Reinforcement Fibers into Asphalt Mix as specified in Section 32 1216.

B. Related Requirements:
   1. Section 32 1216: 'Asphalt Paving'.

### 1.02 PRICE AND PAYMENT PROCEDURES

A. Alternates:
   1. Asphalt Reinforcement Fibers are bid as Alternate 'A' as specified in Price and Payment Procedures in Part 1 of Section 32 1216. Owner's Representative will review bid and decide if asphalt reinforcing fibers will be included in Project.

### 1.03 REFERENCES

A. Association Publications:
   1. Arizona State University, School of Sustainable Engineering and the Built Environment Department of Civil, Environmental, and Sustainable Engineering, Tempe, Arizona:
      a. 'Extraction of Aramid Fibers from Fiber Reinforced Asphalt Concrete – Special Test Method' (May 11, 2016) by Waleed Zeiada and Shane Underwood.

B. Definitions:
   1. Asphalt Reinforcement Fibers: High tensile strength aramid fiber blend specially formulated to reinforce hot mix or warm asphalt. A blend of high tensile-strength synthetic fibers that are uniformly dispersed into hot or warm mix asphalt to increase durability and longevity of asphalt paving. Asphalt reinforcement fibers can be of polyester, polypropylene or aramid (This specification requires use of aramid fibers).
      a. Aramid Fibers: Uniformly mixed and coated with asphalt at asphalt plant and dispersed into asphalt mix using delivery systems such as being combined with fibrillated polyolefin fibers or being wax coated.
      b. Aramid Dispersion State Ratio (ADSR): Mass of aramid in individual state compared to total mass of extracted aramid fibers, expressed as percentage.
   2. See Section 32 1216: 'Asphalt Paving' for additional common asphalt paving definitions.
      a. Reference Standards:
   3. American Association of State and Highway Transportation Officials:
      a. AASHTO T322: 'Determining the Creep Compliance and Strength of Hot-Mix Asphalt (HMA) Using the Indirect Tensile Test Device'.
   4. ASTM International:
      a. ASTM D2172/D2172M-17, 'Standard Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures'.
      b. ASTM D2256/ D2256M-10(2015), 'Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method'.
      c. ASTM D6932/D6932M-08(2013), 'Standard Guide for Materials and Construction of Open-Graded Friction Course Plant Mixtures'.

### 1.04 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Asphalt Reinforcement Fibers:
         1) Manufacturer's published product data and certification that product supplied meets requirements of this specification.
         2) Provide certified test data for asphalt reinforcement fibers.

3) Manufacturer's instructions and general recommendations.
2. Submit a minimum of five unique project examples and references where the reinforcing fiber product was used.
3. Samples:
a. Asphalt Reinforcement Fibers:
1) Manufacturer to provide statement certifying:
(a) Fiber material and mix rate meet requirements of this specification.

B. Informational Submittals:
1. Tests And Evaluation Reports:
a. Asphalt Reinforcement Fibers:
1) Indirect Tensile (IDT) Strength Test results (AASHTO T322 or D6932/D6932M) from minimum of three (3) separate laboratory trials:
(a) Tests must be performed by AASHTO Independent Testing Agency meeting qualifications as specified in Section 01 4301 'Quality Assurance - Qualifications' and reviewed and approved by project engineer.
(b) Perform indirect tensile tests using the following protocol:
(1) Specimen height range of 1.50 inches (38 mm) to 2.46 inches (62.48 mm).
(2) Specimen diameter range of 4.00 inches (101.6 mm) to 5.91 inches (150.11 mm).
(3) Actuator displacement rate of 2.0 inches (50.8 mm) /min (plus or minus 0.10 inches (2.54 mm) / minute).
(4) Test temperature range 40 deg F (4.4 deg C) to 77 deg F (25 deg C).
(5) Other test parameters and methods as detailed in AASHTO T322 or ASTM D6932/D6932M.
(c) Tests results shall include control and fiber reinforced mix. Fiber reinforced asphalt concrete (FRAC) mix shall be identical to control mix except for inclusion of fibers added at same dosage as proposed on Project.
(d) Indirect tensile test results from fiber specimens shall show average tensile strength increase of fifteen (15) percent over control specimen with no single result less than ten (10) percent increase of average tensile strength.
2) Perform Aramid Dispersion State Ratio (ADSR) Tests from minimum of two separate laboratory trials:
(a) Perform ADSR tests based on modified ASTM D2172/D2172M procedures as provided in document 'Extraction of Aramid Fibers from Fiber Reinforced Asphalt Concrete – Special Test Method' by Arizona State University:
(1) Samples must be obtained during production run of fiber reinforced asphalt concrete (FRAC) mixed at full-scale asphalt plant.
(2) Fiber extraction results should result in average extracted fiber content of not less than 0.007 percent by total sample weight with no individual result less than 0.005.
(3) All tested fiber mixes must achieve a minimum ADSR of 85 percent.

## 1.05 QUALITY ASSURANCE

A. Qualifications. Requirements of Section 01 4301 'Quality Assurance - Qualifications' applies but not limited to following:
1. Asphalt Reinforcement Fiber:
a. Provide list of five (5) project examples and references of completed projects of comparable quality, similar size, and complexity in past five (5) years before bidding.
b. Upon request, submit documentation.

## 1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
1. Asphalt Reinforcement Fibers:

a. Store fibers in dry environment.
b. Do not allow contact with moisture.
c. Keep sand and dust out of boxes.

## PART 2 PRODUCTS

### 2.01 MATERIAL

A. Asphalt Reinforcement Fibers:
1. General:
a. Reinforcing fiber blend of virgin polyolefins and virgin aramids.
2. Design Criteria - Comply with following fiber characteristics:
a. Tensile Strength: 400,000 psi (2 758 MPa) as per ASTM D2256/ D2256M.
b. Specific Gravity: 1.44 +/- 0.01.
c. Acid/Alkali Resistance: Inert.
d. Melting Temperature: 800 deg F (427 deg C).
e. Melting Temperature for dispersing fibers, if used: 212 deg F (100 deg C) maximum.
f. Fiber Size:
1) Fiber length shall be 3/4 inch +/- 1/16 inch (19 mm +/- 2 mm) for surface course mixes.
2) Fiber diameter shall be 0.00047 inches (12 microns +/- 2 microns).
g. Non-aramid fiber blends will not be considered as acceptable.
3. Dosage Rate:
a. Pure aramid fibers, not including any blended fibers or coatings, shall be used at minimum dosage rate of 2.1 oz (59.5 g) per 1 ton (1.02 metric ton) of asphalt.
b. Mixture of pure aramid fibers combined with distributing fibers to be 16 oz (454 g) per 1 ton (1.02 metric ton).
4. Acceptable Products:
a. FORTA-FI asphalt reinforcement fibers as manufactured by Forta Corporation, Grove City, PA www.forta-fi.com. Distributed by Alliance Geosynthetics, Inc.
1) Contact Information: phone (949) 610-6098, email - joseph@alliancegeo.com.
b. Equal as approved by Architect at least two weeks prior to bid date. See Section 01 6200.

## PART 3 EXECUTION

### 3.01 INSTALLERS

A. Acceptable Applicators:
1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification:

### 3.02 APPLICATION

A. Asphalt Reinforcement Fibers:
1. Batching and Mixing:
a. General:
1) Add fiber manually or through specialized equipment that can accurately proportion or meter, by weight, proper amount per batch for batch plants, or continuously and in steady uniform manner for drum plants.
2) Add aramid and polyefin reinforcing fiber blends at a dosage rate of one pound per one ton of asphalt.
3) Add alternative aramid fiber blends at a rate proposed by the manufacturer that achieves the IDT and ADSR results required.
b. Batch Plant:
1) When batch plant is used, add fibers to aggregate in weigh hopper and follow Manufacturer recommendations for both dry and wet mixing times.
2) Ensure fibers are uniformly distributed before injection of asphalt cement into mixture.

3) Accurately proportion by weight proper amount per batch controlled to within plus or minus ten (10) percent of required weight of asphalt reinforcement fibers.
4) Where warm mix technologies are used, remove fibers from bags.

c. Drum Plant:
1) Accurately proportion by weight the proper amount per batch controlled to within ten (10) percent of required weight of asphalt reinforcement fibers.
2) Inject fibers through RAP collar by placing 1 lb (0.45 kg) bags of fibers on RAP belt or by feeding them through blower tube.
3) Rate feeding of fibers with rate plant is producing asphalt mix.
4) For blower tube system, add fibers continuously in steady uniform manner. Provide automated proportioning devices and control delivery within plus or minus ten (10) percent of mass of fibers required. Perform equipment calibration to satisfaction of Fiber Manufacturer's Representative to show that fiber is being accurately metered and uniformly distributed into mix (visual inspection at discharge chute).
5) If there is evidence of clumps of fibers at discharge chute or during laydown, increase mixing time and/or temperature or change angle of fiber feeder line to increase dry mixing time.

d. Have Fiber Manufacturer's Representative on site during first day of mixing and production. This requirement can be waived if fiber manufacturer and asphalt producer can supply evidence of manufacturer's brand of fiber having been successfully produced minimum of three (3) times at asphalt plant to be used for Project.

## 3.03 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
a. Quality Control is sole responsibility of Contractor:
1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
(a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
(b) Contractor bears full responsible for compliance with all contract requirements and quality control on project and will be responsible for quality of asphalt mixture and asphalt installation.

B. Aramid Dispersion Visual Test:
1. Collect 10kg sample of mix from discharge chute during first 50 tons of production. Visually asses state of aramid fibers in sample and rate sample as "Pass" or "Fail".
a. "Pass": All fibers exist in an Individual State.
b. "Fail": One or more Agitated Bundles are detected.
2. If sample is rated as "Fail", adjust mixing operations to improve fiber dispersion and repeat test.
3. If visual test results in three consecutive "Fail" ratings, plant mix samples should be sent to a third party laboratory for complete ADSR testing before production is allowed to commence.
4. In addition to visual test, observe FRAC mix in back of first three trucks and every tenth truck thereafter to confirm adequate blending of fiber.
5. Remove any observed fiber balls from placed mixture and adjust operations per manufacturer's recommendation to eliminate future fiber ball development, and repeat Steps 1 through 3 above to confirm adequate aramid fiber dispersion.

**END OF SECTION**

**SECTION 32 1723.01**
**PAVEMENT MARKINGS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish acrylic paint and apply pavement and curb markings as described in Contract Documents including:

### 1.02 REFERENCES

A. Reference Standards:
   1. Federal Specifications and Standards:
      a. FED-STD-595C, 'Federal Standard: Colors Used in Government Procurement' (16 Jan 2008).
      b. FED TT-P-1952F, 'Paint, Traffic and Airfield Marking, Waterborne' (17 Feb 2015).
   2. Master Painters Institute:
      a. MPI (APL) - Master Painters Institute Approved Projects List; Master Painters and Decorators Association; Current Edition.
   3. Department of Transportation Federal Highway Administration:
      a. FHWA MUTCD-10, 'Manual on Uniform Traffic Control Devices'.

### 1.03 SUBMITTALS

A. Action Submittal:
   1. Product Data:
      a. Manufacturer's published product data and certification that product supplied meets requirements of this specification.

B. Informational Submittal:
   1. Test And Evaluation Reports:
      a. Acrylic Paint:
         1) Provide reports showing compliance to FED TT-P-1952F.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturer's Documentation:
            (a) Product data.
            (b) Specification compliance documentation.
         2) Testing and Inspection Reports:
            (a) Reports showing compliance.

### 1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Paint must meet requirements of FED TT-P-1952-F and local regulations for VOC.
   2. Paint handicap spaces to conform to ADA Standards and local code requirements.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Materials shall be delivered in original, unopened containers with labels intact.
      a. Labels to include:
         1) Manufacturer's name and address.
         2) TT-P-1952F reference.
         3) Classification Type.
         4) Color.

B. Storage And Handling Requirements:

1. Follow Manufacturer's storage and handling requirements.
2. Protect stored material from freezing at temperatures above 35 deg F or above 115 deg F.
3. Do not invert or roll containers.

**1.06 FIELD CONDITIONS**

A. Ambient Conditions:
   1. Acrylic Paint:
      a. Apply only on dry clean surfaces, during favorable weather (not excessively windy, dusty, or foggy), and when damage by rain, fog, or condensation not anticipated.
      b. Paving surface and Ambient temperature shall be minimum 50 deg F and rising.
      c. Temperature shall not drop below 50 deg F within twenty-four (24) hour period following application.
      d. Acetone based paints that are one hundred (100) percent acrylic shall not drop below 32 deg F within twenty-four (24) hour period following application.

**PART 2 PRODUCTS**

**2.01 MATERIAL**

A. Acrylic Paint:
   1. Description:
      a. Low VOC, ready-mixed, one- component, acrylic waterborne traffic marking paint suitable for application on concrete, asphalt, sealers, and previously painted areas of these surfaces.
   2. Design Criteria:
      a. General:
         1) Traffic Paint.
         2) Non-volatile portion of vehicle for all classification types shall be composed of one hundred (100) percent acrylic.
         3) Meet FED TT-P-1952F specification requirements.
         4) Fast drying when applied at ambient conditions requirement.
         5) Low VOC.
         6) Non-Reflectorized.
         7) Traffic paints not intended for use as floor paints. Do not use on pedestrian walkways or large surfaces such as ramps, floors and stairs which may become slippery when wet.
      b. Classification:
         1) Type I for use under normal conditions.
         2) Type II for use under adverse conditions.
         3) Type III for increased durability.
      c. Composition:
         1) Non-volatile portion for all types shall be composed of one hundred (100) percent acrylic polymer as determined by infrared spectral analysis.
         2) Prohibited material:
            (a) Product does not contain mercury, lead, hexavalent chromium, toluene, chlorinated solvents, hydrolysable chlorine derivatives, ethylene-based glycol ethers and their acetates, nor any carcinogen.
      d. Qualitative Requirements:
         1) Meet FED TT-P-1952F requirements for:
            (a) Abrasion resistance.
            (b) Accelerated package stability.
            (c) Accelerated weathering.
            (d) Appearance.
            (e) Color requirements:
            (f) Color Match (all colors except white and yellow).
            (g) Daylight directional reflectance.

(h) Yellow color match.
(i) Condition in container.
(j) Dry-through (early washout) for Type II only.
(k) Flexibility.
(l) Freeze/thaw stability.
(m) Heat-shear stability.
(n) Scrub resistance.
(o) Skinning.
(p) Titanium dioxide content.
(q) Water resistance.

e. Quantitative requirements:
1) Meet FED TT-P-1952F requirements (Table 1).
2) Acetone based paints that are one hundred (100) percent acrylic and have exempt status under Federal law are exempt from meeting FED TT-P-1925F requirements.

3. Colors:
a. General:
1) Traffic Paint will be furnished in white and any Federal Standard 595 color in accordance to FED-STD-595C:
(a) Yellow: 33538.
(b) Blue: 35180.
(c) Red: 31136.

b. White (Yellow may be used at Owner Representative's discretion):
1) Lane lines, edge lines, transverse lines, arrows, words, symbol markings, speed bump markings, parking space markings.

c. Yellow:
1) Cross-hatching in medians, cross hatching in safety zones separating opposing traffic flows, crosswalk stripes, safety markings, centerlines, edge lines along left edge of one-way roadway or one-way ramp.

d. Blue And White:
1) In parking spaces specifically designated as reserved for disabled.

e. Red:
1) Fire lanes, no parking zones, special raised pavement markers that are placed to be visible to "wrong-way" drivers.

4. Type Two Acceptable Products:
a. Any product meeting design criteria of this specification as approved by Architect/Owner's Representative before application. See Section 01 6200.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Acrylic Paint:
1. Asphalt Surfaces:
a. Do not apply paint until asphalt has cooled.
b. Allow new seal coated surfaces to cure for at least twenty-four (24) hours before applying paint.
2. Concrete Surfaces:
a. Do not apply paint to new concrete surfaces until concrete has cured seven (7) days minimum.

B. Surfaces shall be dry and free of grease and loose dirt particles.
1. Scrape and wire brush chipped, peeling, or damaged paint on existing curbs.

C. Perform layout with chalk or lumber crayon only.

### 3.02 APPLICATION

A. General:
   1. Mix in accordance and apply as per Manufacturer's instructions.
   2. Apply at locations and to dimensions and spacing as shown on Contract Drawings.

B. Tolerances:
   1. General: Make lines parallel, evenly spaced, and with sharply defined edges.
   2. Line Widths:
      a. Plus or minus 1/4 inch variance on straight segments.
      b. Plus or minus 1/2 inch variance on curved alignments.

C. Coverage:
   1. Paint stripes added to new asphalt and concrete surfaces:
      a. Apply single coat.
   2. Paint stripes applied to existing asphalt and concrete surfaces:
      a. Apply single coat to existing asphalt parking lots which are being re-striped and where no surface treatments are being applied to asphalt.
      b. Apply single coat to existing concrete parking lots which are being re-striped.
      c. Apply single coat to existing concrete curbs.
   3. Paint stripes applied to new asphalt paving surface treatment over existing asphalt paving.
      a. Except for slurry seal:
         1) Apply single coat after seal coat has completely dried.
      b. Slurry seal coat:
         1) Apply first coat after seal coat has completely dried.
         2) Apply second coat after first coat has thoroughly dried and then wait thirty (30) to forty-five (45) days and after ravel sweeping to apply second coat.
   4. Apply traffic paint at rate of 13 to 15 mils minimum wet thickness, 8 to 9 mils dry thickness. Application at more than 15 mils may result in extended dry times and may cause lifting or cracking on some asphalt surfaces.

## 3.03 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Replace or correct defective material not conforming to requirements of this specification or any work performed that is of inferior quality at no cost to Owner.

## 3.04 CLEANING

A. General:
   1. Remove drips, overspray, improper markings, and paint material tracked by traffic by sand blasting, wire brushing, or other method approved by Architect/Owner’s Representative before performance.

B. Waste Management:
   1. Remove debris resulting from work of this Section. Dispose of or recycle all trash and excess material in manner conforming to current EPA regulations and local laws.

**END OF SECTION**

**SECTION 32 3113**
**CHAIN LINK FENCES AND GATES**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete fence and gates as described in Contract Documents.

B. Related Requirements:
   1. Section 03 3000: ‘Cast-In-Place Concrete’ for mow strips at fencing and setting sleeves in concrete retaining walls.
   2. Section 05 1200: 'Structural Steel Framing' for priming and galvanizing repair.
   3. Section 05 5000: 'Metal Fabrications' for welding requirements.

### 1.02 REFERENCES

A. Association Publications: / Organizations:
   1. Chain Link Fence Manufacturers Institute (CLFMI), Columbia, MD www.chainlinkinfo.org.
      a. CLFMI WLG 2445 , 'Chain Link Fence Wind Load Guide for the Selection of Line Post and Line Post Spacing'.
      b. CLFMI CLF-SFR0111 , 'Chain Link Fence Manufacturers Institute Security Fencing Recommendations'.
      c. CLFMI CLF-PM0610 , 'Field Inspection Guide'.
      d. CLF-TP0211, 'Tested and Proven Performance of Security Grade Chain Link Fencing Systems'.

B. Reference Standards:
   1. ASTM A123/A123M, ‘Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products’.
      a. ASTM A153/A153M-16a, ‘Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware’.
   2. ASTM A392-11a(2017), 'Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric'.'
   3. ASTM A1011/A1011M-18a, ‘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’.
   4. ASTM C1107/C1107M-17, ‘Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)’.
   5. ASTM F1043-18, ‘Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework’.
   6. ASTM F1083-18, ‘Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures’.
   7. ASTM F3000/F3000M-13(2018), ‘Standard Specification for Polymer Privacy Insert Slats for Chain Link Fabric and Privacy Chain Link Fabric Manufactured Containing Pre-Installed Privacy Slats’.

### 1.03 SUBMITTALS

A. Submittals for Review:
   1. Do not commence work or deliver products to site until Landcape Architect approves submittals for review.
   2. Product Data:
      a. Manufacturer literature or cut sheets on fence components.
      b. Types of vision slats and colors for Architect's selection.
   3. Samples: Types of vision slats and colors for Architect's selection.

B. Submittals for Closeout:
   1. Operations and Maintenance Data:

a. Manufacturer Instructions
    1) Maintenance instructions.
b. Warranty Documentation:
    1) Vision Slats:
        (a) Final, executed copy of Warranty. See section below.

**1.04 WARRANTY**

A. Vision Slats:
    1. Manufacturers twenty-five (25) year, pro-rata limited Warranty.

**PART 2 PRODUCTS**

**2.01 ASSEMBLIES**

A. Materials:
    1. Fabric:
        a. Chain Link Fabric of 9 ga (3.7 mm) wire, galvanized before or after weaving with 1.2 ounce (34 grams) zinc coating conforming to requirements of ASTM A392, Class I.
        b. Mesh:
            1) With Visual Privacy / Security Slats:
                (a) 2 inch (50 mm) square mesh required by specified vision slat.
                (b) 3-1/2 inch by 5 inch (89 mm by 125 mm) mesh as required by specified vision slat.
                (c) Without Visual Privacy / Security Slats:
                    (1) 2 inch (50 mm) square mesh or 3-1/2 inch by 5 inch (89 mm by 125 mm) mesh as selected by Architect.
        c. Knuckle both selvages.
    2. Framework:
        a. Posts and Rails shall be roll-formed, self-draining shapes meeting strength requirements of ASTM F1043, Table 3, and with 2 ounce (56.7 grams) zinc coating per 1 sq ft (0.0929 sq meter) of surface area conforming to ASTM A123/A123M.
        b. Line Posts:
            1) Line Posts 8 feet (2.45 m) and under:
                (a) 5 by 1.625 inch (48 by 41 mm) C-section roll formed from steel conforming to ASTM A1011/A1011M, Grade 45, with minimum theoretical bending strength of 247 lbs (112 kg) under 6 foot (1.80 m) cantilever load.
                (b) 5 inch (60 mm) outside diameter Schedule 40 tubular section weighing 3.65 lbs (1.6 kg) per lineal 1 ft (305 mm) meeting requirements of ASTM F1083.
                (c) 5 inch (60 mm) outside diameter Schedule 40 tubular section weighing 3.12 lbs (1.42 kg) per lineal 1 ft (305 mm) formed from steel meeting requirements of ASTM A1011/A1011M.
                (d) Line Posts over 8 feet (2.45 m):
                    (1) by 1.70 inch (57 by 43 mm) C-section meeting other requirements given above.
                    (2) 5 inch (48 mm) outside diameter Schedule 40 tubular section weighing 5.79 lbs (2.63 kg) per lineal 1 ft (305 mm) meeting requirements of ASTM F1083.
                    (3) 5 inch (48 mm) outside diameter Schedule 40 tubular section weighing 4.64 lbs (2.11 kg) per lineal 1 ft (305 mm) formed from steel meeting requirements of ASTM A1011/A1011M.
        c. Terminal And Gate Posts:
            1) Gate Posts and gate posts for gate leaves under 6 feet (1.80 m) wide:
                (a) by 3.5 inch (89 by 89 mm) roll formed section with minimum theoretical bending strength of 486 pounds (220.5 kg) under 6 foot (1.80 m) cantilever load.

(b) 3 inch (76 mm) outside diameter Schedule 40 pipe weighing 5.79 lbs (2.63 kg) per lineal 1 ft (305 mm) meeting requirements of ASTM F1083.

(c) 3 inch (76 mm) outside diameter Schedule 40 tubular section weighing 4.64 lbs (2.11 kg) per lineal 1 ft (305 mm) formed from steel meeting requirements of ASTM A1011/A1011M.

(d) Gate Posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths over 6 feet (1.80 meter):

| Leaf Width | Post Outside Diameter | Lbs / lin ft (305 mm) |
|---|---|---|
| Over 6 ft (1.80 m) to 13 ft (3.96 m) | 4 inches (100 mm) | 9.11 (4.13 kg) |
| Over 13 ft (3.96 m) to 18 ft (5.49 m) | 6.625 inches (168 mm) | 18.97 (8.60 kg) |
| Over 18 ft (5.49 m) | 8.925 inches (227 mm) | 28.55 (12.95 kg) |

d. Top And Brace Rail:
   1) by 1.25 inch (41 by 32 mm) roll formed section of 45,000 psi (310 MPa) yield strength channel shaped rail with minimum theoretical bending strength of 247 lbs (112 kg) on 10 foot (3.050 m) midpoint load.
   2) 0 inch 42 mm outside diameter Schedule 40 pipe weighing 2.27 lbs (1.03 kg) per lineal 1 ft (305 mm) meeting requirements of ASTM F1083.
   3) 0 inch 42 mm outside diameter Schedule 40 tubular section weighing 1.84 lbs (0.83 kg) per lineal 1 ft (305 mm) formed from steel meeting requirements of ASTM A1011/A1011M.

e. Fittings:
   1) Pressed steel or malleable iron, hot-dip galvanized conforming to ASTM A153/A153M.
   2) Tie wires shall be 12 ga (2.05 mm) minimum galvanized steel or 9 ga (3 mm) minimum aluminum wire.

f. Tension Wire: 7 ga (3.66 mm) minimum galvanized spring steel.

3. Gate Leafs Wider Than 6 Feet (1.80 Meters):
   a. Fabricate perimeter frames from metal and finish to match fence framework. Assemble frames by welding or with special fittings and rivets, for rigid connections, providing security against removal or breakage connections.
      1) Provide same fabric as for fence. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretchers bars to frame at not more than 15 inches (380 mm) on center.
      2) Install diagonal cross-bracing consisting of 3/8 inch (9.5 mm) diameter adjustable length truss rods to ensure frame rigidity without sag or twist.
   b. Swing Gates: Fabricate perimeter frames of minimum 1.90 inches (48.26 mm) OD pipe.
   c. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A153/A153M, and in accordance with following:
      1) Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6 foot (1.80 m) nominal height.
      2) Latch At Paving: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
   d. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.
   e. Double Gates:
      1) Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar.

2) Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

f. Sliding Gates: Provide Manufacturer's standard heavy-duty inverted channel track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

B. Mixes:

1. Post Foundation Concrete:
   a. One cu ft cement, 2 cu ft (0.0566 cu m) sand, 4 cu ft (0.1132 cu m) gravel, and 5 gallons (18.93 liters) minimum to 6 gallons (22.71 liters) maximum water.
   b. Mix thoroughly before placing.

## 2.02 ACCESSORIES

A. Post Setting Grout at Sleeves:

1. Commercial nonshrink grout conforming to requirements of ASTM C1107/C1107M, Type B or C.
2. Type Two Approved Products:
   a. Normal Construction Grout A by W R Bonsal, Charlotte, NC www.bonsal.com.
   b. Advantage 1107 Grout by Dayton Superior, Miamisburg, OH www.daytonrichmond.com.
   c. NS Grout by Euclid Chemical Co, Cleveland, OH www.euclidchemical.com.
   d. 5 Star Special Grout 110 by Five Star Products Inc, Fairfield, CT www.fivestarproducts.com.
   e. Duragrout by L&M Construction Chemicals Inc, Omaha, NE www.lmcc.com.
   f. Masterflow 713 Pre-mixed Grout by Master Builders, Cleveland, OH www.masterbuilders.com.
   g. Tamms Grout 621 by TAMMS Industries, Mentor, OH www.tamms.com.
   h. U S Spec MP Grout by U S Mix Products Co www.usspec.com.
   i. CG-86 Grout by W R Meadows, Elgin, IL www.wrmeadows.com.
   j. Equal as approved by Architect before use. See Section 01 6200.

B. Vision Slats And Fabric:

1. Manufacturer Contact List:
   a. PrivacyLink, Hyde Park, UT www.eprivacylink.com.
2. Description:
   a. High-density polyethylene (HDPE), double-walled, self-locking or with locking feature that prevents slats from being removed
   b. Slats pre-woven and pre-inserted into chain link fabric.
3. Design Criteria:
   a. Meet ASTM F3000/F3000M requirements for pre-installed privacy slats.
   b. Provide slats with ultra violet (UV) inhibitors.
4. Visual Privacy / Security:
   a. Near-Total Privacy:
      1) Description:
         (a) When installed, slats will provide 98 percent minimum visual privacy/security.
         (b) Mesh: 2 inch x 2 inch (50 mm x 50 mm).
         (c) Pre-inserted Slats:
            (1) Double-wall with wings on each side of slat that wedge slats tightly into mesh and secured in place at both top and bottom of fence by flexible round tubes.
         (d) Type Two Acceptable Product:
            (1) Noodle Link Plus by PrivacyLink.
            (2) Equal as approved by Architect before installation. See Section 01 6200.

5. Color:
    a. Slats:
        1) Beige color.
    b. Flexible round tubes:
        1) Galvanized Grey.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Fence shall be installed by mechanics skilled and experienced in erecting fences of this type and in accordance with Contract Documents.
    1. When general ground contour is to be followed, make changes of grade in gradual, rolling manner.
    2. Evenly space posts in line of fence a maximum of 10 feet (3.050 meter) center to center.

B. Post Foundations:
    1. Except atop retaining walls, set posts with concrete post foundations as specified below:
        a. Line Posts:
            1) Diameter 8 inch (200 mm)
            2) Depth 36 inch (915 mm).
        b. Gate, End, And Corner Posts:
            1) Diameter 12 inch (305 mm)
            2) Depth 42 inch (1 065 mm).
        c. At mow strips, set top of post foundation below grade sufficient to allow for placing of mow strip. Measure post foundation depth from top of mow strip.
        d. Where fences are incorporated into slabs, measure post foundation depth from top of slab. Extend bottom of slab footing sufficient to allow specified amount of concrete around post. At existing slabs, install fence outside perimeter of slab.
        e. For fences on retaining walls, provide 12 inch (305 mm) long sleeves to be cast into retaining wall. Set pipe in sleeve and grout space between sleeve and post full.

C. Fence:
    1. After posts have been permanently positioned and concrete cured for one (1) week minimum, install framework, braces, and top rail. Join top rail with 6 inch (150 mm) minimum couplings at not more than 21 foot (6.40 meter) centers.
    2. Stretch fabric by attaching one end to terminal post and supplying sufficient tension to other end of stretch so slack is removed.
        a. Fasten fabric to line posts with tie wires. Pass ties over one strand of fabric and hook under line post flange.
        b. Place one tie as close to bottom of fabric as is possible with additional ties equally spaced between top and bottom band on approximately equal spacing not to exceed 14 inches (355 mm) on center.
        c. Attach fabric to roll formed terminals by weaving fabric into integral lock loops formed in post. Attach fabric to tubular terminals with tension bars and bands.
        d. Hold fabric approximately 2 inches (50 mm) above finish grade line.
        e. On top rail, space tie wires at no more than 24 inches (610 mm) on center.
        f. Securely attach fittings and firmly tighten nuts.

D. Gates:
    1. Weld gate frames and provide for free and easy operation.
    2. Provide gate latching device with padlocking capabilities. Provide cane bolt to engage sleeve set in concrete at double gates.
    3. Align top bar of gates with top rail of fence.
    4. Gates shall be plumb and on same plane as fence, both vertically and horizontally.
    5. Set gate stops and other catches in concrete.

### 3.02 CLEANING

A. Spread dirt from foundation excavations evenly around surrounding area unless otherwise directed. Leave area free of excess dribbles of concrete, pieces of wire, and other scrap materials.

**END OF SECTION 32 3113**

**SECTION 32 8423**
**UNDERGROUND SPRINKLERS - NO CONTROLLERS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Furnish and install landscape irrigation system as described in Contract Documents complete w ith accessories necessary for proper function.

### 1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 0533.13 - Conduit for Electrical Systems.

D. Section 31 2316 - Excavation and Trenching: Excavating for irrigation piping.

E. Section 31 2323 - Fill and Aggregate Base: Backfilling for irrigation piping.

F. Section 32: 8466: Underground Sprinklers: Controllers.

G. Section 32 9001: Common Planting Requirements' for pre-installation conference held jointly with other common planting related sections.

H. Section 32 9120: Topsoil And Placement' for topsoil evaluation and placement required for topsoil grading.

I. Section 32 9122: 'Topsoil Grading' for preparation of topsoil and addition of amendments prior to landscaping.

J. Section 32 9223: 'Sodding'.

K. Section 32 9300: 'Plants'.

L. Section 33 1416 - Site Water Utility Distribution Piping.

### 1.03 REFERENCE STANDARDS

A. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2015.

B. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.

C. ASTM F656 Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

### 1.04 DEFINITIONS

A. Certified Water Audit: Irrigation system audit performed by Certified Landscape Irrigation Auditor (CLIA) as defined by Irrigation Association (https://www.irrigation.org/). Include water audit if required by AHJ, if installing in a high wind area, or if installing in high water cost area. Remove all references if not required.

B. High Wind Area: Area with average sustained wind speed of over 7.5 mph (12 km/hr).

C. Landscape Management Plan (LMP): See Section 32 9001 for definition and format.

D. Lateral Line: Downstream from automatic control valves to application devices, heads, and emitters. Piping or tubing is under pressure during flow. In areas where potable or secondary water are used, line shall be white. In areas where non-potable or reclaimed water are used, line shall be purple.

E. Main Line: Downstream from point of connection to automatic control valves. Piping is under water-distribution-system pressure when activated by master valve or hydrometer. In areas where potable or secondary water are used, line shall be white. In areas where non-potable or reclaimed water are used, line shall be purple.

F. Plant Establishment Period: See Section 32 9001 for definition.

G. Point of Connection: Location where water enters irrigation system.

H. Post-Plant Establishment Period: Time following Plant Establishment Period.

I. Source Pressure Test: Test to determine water source pressure.

J. Static Water Pressure: Pressure at point of connection when system is not in operation.

K. System Pressure Test: Test to evaluate system pressure when pressurized.

L. Two Wire Path: See Section 32 8466 for definition.

M. Working Pressure: Pressure at point of connection when system is in operation.

## 1.05 ADMINISTRATIVE REQUIREMENTS

A. Only specify materials approved by the AHJ.

B. Coordination: Coordinate work with other Sections.

C. Provide sufficient notice to the Landscape Architect and all other pertinent parties to participate in the following tasks.
   1. Preinstallation Meeting: Convene seven days minimum prior to commencing work of this section.
      a. Prior to irrigation system installation review mockups, testing, inspection, certification, and submittal requirements.
   2. System Pressure Test: Provide two days notification prior to commencing.
   3. Inspections: Provide seven days notification prior to commencing.
   4. Substantial Completion: Provide seven days notification prior to commencing.
   5. Final Acceptance: Provide seven days notification prior to commencing.
   6. Perform Winter Shut-Down and Spring Start-Up per Part 3: Provide notification upon completion.

D. Sequencing:
   1. Install sleeves and conduit before installation of cast-in-place concrete site elements and paving.

## 1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures. Submittals may be included in more than one submittal group listed below.

B. Submittals for Review
   1. Do not commence work or deliver products to site until Landscape Architect approves submittals for review.
   2. Product Data:
      a. Provide manufacturer's cut sheets for each system element.
   3. Pressure tests:
      a. Prior to main line burial, document pressure test results as follows:
         1) Take photos.
         2) Write description including but not limited to:
            (a) Start time,
            (b) Completion time,
            (c) Processes used,
            (d) Issues encountered
            (e) Methods of resolving issues.

C. Submittals for Information (Coordinate with Sections 32 8466 and 32 9000):
   1. Irrigation System Approval:
      a. When irrigation system is approved, Landscape Architect will provide signed acknowledgement:
         1) Include name and signature of Landscape Architect, Landscape Architect’s company, Landscape Architect’s telephone number, and date of review.
         2) State to best of Landscape Architect’s knowledge that the system is in full compliance with Contract Documents.
   2. Establishment Period Acknowledgement (See LMP):
      a. Landscape Architect will provide acknowledgment of Establishment Period commencement:

1) Include name and signature of Installer, Installer's company, Installer's telephone number, and date.
2) Include name and signature of Owner's Representative, Owner's Representative Group name, Owner's Representative Group telephone number, and date.
3) Include date when Establishment Period begins and that it extends one (1) year from that time.

3. Training Acknowledgement (See LMP):
   a. Landscape Architect will provide acknowledgement that training has been performed:
      1) Include name and signature of Installer, Installer's company, Installer's telephone number, and date.
      2) Include name and signature of Owner's Representative, Owner's Representative Group name, Owner's Representative Group telephone number, and date.
      3) Acknowledge Owner's Representative has been trained in operation and maintenance of system.
4. Certified Water Audit - If required by AHJ.
   a. Irrigation system zone by zone evaluation of:
      1) Distribution uniformity.
      2) Zone precipitation rates.
      3) Recommended run times during hottest time of year.
      4) Recommended system modifications.

D. Submittals for Project Closeout
1. Operation and Maintenance Data (Digital Format Only):
   a. Contractor's directions for system operation and maintenance:
      1) Winter start-up and spring shut-down,
      2) Seasonal modifications,
   b. Manufacturer's printed literature for operating and maintaining elements of system.
      1) Manufacturer's parts catalog.
      2) Manufacturer's printed literature for operating and maintaining elements of system.
   c. Contractor's recommended run times for each valve. Combine directives from Certified Water Audit (if pertinent) and directives as found in Section 32 8466.
   d. System Pressure Test Report(s)
2. Record Documentation:
   a. Irrigation Drawings: Record actual locations of all concealed components. As installation occurs prepare accurate record drawings:
      1) Detail and dimension changes made during construction.
      2) Field dimension locations from permanent above grade surfaces or edges to valve boxes, manual drains, quick coupler valves, and control wire runs not in main line ditch. Field dimension to both ends of sleeves.
      3) Laminated
         (a) 11 x 17 inches (275 x 425 mm).
         (b) Show color keyed zones.
         (c) Mount on 12 x 18 inch (300 x 450 mm) hard board drilled with two (2) 1/2 inch (13 mm) holes at top of board.
         (d) Hang on hooks in Custodial Room or location designated by Owner's Representative.
      4) Un-Laminated to be included in Landscape Management Plan (LMP):
         (a) 11 x 17 inches (275 x 425 mm).
         (b) Show color keyed zones.
   b. Photographs: Prior to burial take photographs of key elements including but not limited to:
      1) Valves
      2) Drains
      3) Hydrometer
3. System warranty. One year minimum.

4. Landscape Management Plan.
    a. Irrigation Section. Include the following:
        1) Operation and Maintenance Data.
        2) Record Documentation including Irrigation Drawings and Photographs.
        3) System warranty
        4) Establishment Period Acknowledgement
        5) Training acknowledgment
        6) Certified Water Audit.

E. Maintenance Material Submittals: Provide the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. One (1) heavy-duty key for stop and waste or main shut-off valve.
    3. One (1) quick coupler key with brass hose swivel.

F. Final payment will not be made until all submittals are received and reviewed by the Architect and Landscape Architect

**1.07 QUALITY ASSURANCE**

A. Work and materials shall comply with AHJ requirements. Nothing within contract documents should be construed to permit work not conforming to applicable codes and requirements.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications:
    1. Irrigation Subcontractor
        a. Company specializing in performing work of this section.
        b. Minimum five (5) years experience in irrigation sprinkler installations.
        c. Minimum five (5) satisfactorily completed irrigation sprinkler installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
        d. Use trained personnel familiar with required irrigation sprinkler procedures and with Contract Documents.
        e. Foreman or supervisor required to attend pre-installation conference.
    2. Irrigation Installer
        a. Perform installation under direction of foreman or supervisor.
        b. Minimum three (3) years experience in irrigation sprinkler installations similar in size, scope, and complexity.
    3. Submit documentation upon request.

D. Mockups:
    1. Provide mockups of each valve box detail at staging area.
    2. Mockups may be assembled without solvent weld cement so components can be used in the field.

E. Certified Water Audit - If required by AHJ.
    1. Performed by Certified Water Auditor

**1.08 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements:
    1. Protect materials from damage and prolonged exposure to sunlight.

**1.09 WARRANTY**

A. In addition to standard one (1) year guarantee, warranty shall include:
    1. Filling and repairing depressions and replacing plantings due to settlement of irrigation system trenches.
    2. Repairing equipment and pipe not properly winterized.

**PART 2 PRODUCTS**

**2.01 SYSTEM**

A. Manufacturers (for reference only, may or may not be included in project):
   1. Manufacturer Contact List:
      a. 3M, Austin, TX www.3m.com/elpd.
      b. Action Machining Inc, Bountiful, UT www.actionfilters.com.
      c. Amiad www.amiadusa.com.
      d. Carson by Oldcastle Enclosure Solutions, Auburn, WA www.oldcastleenclosures.com.
      e. GPH Irrigation Products, Fontana, CA www.gphirrigation.com.
      f. Harrington Corporation (Harco), Lynchburg, VA www.harcofittings.com.
      g. Hunter Industries, San Marcos, CA www.hunterindustries.com.
      h. Hydro-Rain, North Salt Lake, UT www.hydrorain.com.
      i. King Innovation, St Charles, MO www.kinginovation.com.
      j. IPS Corporation, Compton, CA www.ipscorp.com.
      k. Leemco, Colton, CA www.leemco.com.
      l. Matco-Norca, Inc. Brewster, NY www.matco-norca.com
      m. Mueller Company, Atlanta, GA www.muellercompany.com
      n. Netafim, Inc. www.netafimusa.com.
      o. Nibco Inc, Elkhart, IN www.nibco.com.
      p. Northstar Industries, LLC, Riverside, CA www.suresplice.com.
      q. Orbit Irrigation Products, Inc. Bountiful, UT www.orbitonline.com.
      r. Paige Electric, Union, NJ www.paigewire.com.
      s. Rain Bird Sprinkler Manufacturing Corp, Glendora, CA www.rainbird.com.
      t. Salco by Weathermatic Irrigation Products, Garland, TX www.weathermatic.com.
      u. Toro Company, Irrigation Div, Riverside, CA www.toro.com.
      v. T. Christy Enterprises, Inc. (Christy's), Anaheim, CA www.tchristy.com.
      w. VAF Filtration Systems, Arvada, CO www.vafusa.com.
      x. Weathermatic Irrigation Products, Garland, TX www.weathermatic.com.
      y. Wilkins a Zurn Company, Paso Robles, CA www.zurn.com.

B. Materials:
   1. Rock-Free Soil:
      a. For use as backfill around PVC pipe.
   2. Pea Gravel:
      a. For use around drains, valves, and quick couplers.
      b. 1/2 inch (13 mm) maximum dimension, washed rock.
   3. Sand: Fine granular material naturally produced by rock disintegration and free from organic material, mica, loam, clay, and other deleterious substances.
   4. Native Material: Soil native to project site free of wood and other deleterious materials and rocks over 1-1/2 inches (38 mm).
   5. Topsoil:
      a. Use soil as described in Section 32 9120 and Section 32 9122.
      b. Achieve depths as described in Section 32 9120 and elevations described in Section 32 9122.
   6. Pipe, Pipe Fittings, And Connections:
      a. General:
         1) Pipe shall be continuously and permanently marked with Manufacturer's name, size, schedule, type, and working pressure.
         2) Pipe sizes shown on Contract Drawings are minimum. Larger sizes may be substituted at no additional cost to Owner.
      b. Piping:
         1) Main Line: Schedule 40 PVC.
         2) Lateral Lines: Schedule 40 PVC.
         3) Filter Assembly Piping: Galvanized steel.
         4) Quick Coupler Piping: Galvanized steel.
      c. Fittings: Same material as pipe, except where otherwise detailed.
         1) Fittings 3 inch (76 mm) or larger: Harco or Leemco of matching size.

2) Use dielectric union fittings between dissimilar metal pipes and fittings.

d. Sleeves:
   1) Under Parking Area And Driveway Paving: Schedule 40 PVC Pipe.
   2) All Other: Class 200 PVC Pipe.
   3) Sleeve diameter shall be two (2) times larger than pipe installed in sleeve.

7. Sprinkler Heads:
   a. Each type of head shall be product of single manufacturer.
   b. Spray Heads in Lawn Areas:
      1) Rain Bird: 1800 SAM-PRS Series (4" and 6") with MPR nozzles.
   c. Rotor Pop-ups:
      1) Rain Bird: 5000 plus PRS with MPR nozzle series.
8. Sprinkler Risers:
   a. Spray Heads (Field Manufactured Assemblies):
      1) Three (3) schedule 40 street ells or Marlex street ells connected to lateral tee to form an adjustable riser or pop-up riser as detailed.
      2) Risers for sprinkler heads 14 inches (355 mm) long minimum and 24 inches (610 mm) maximum.
         (a) Hunter: FLEXsg tubing with HSBE spiral barbed fittings.
         (b) Hydro-Rain: Blu-lock Swing pipe & fittings.
         (c) Rain Bird: Swing Pipe with barbed fittings.
         (d) Toro: Super Funny Pipe with barbed fittings, SPFA-5125, SPFA-51275.
   b. Rotor Pop-Up Sprinklers (Pre-Manufactured Assemblies):
      1) 3/4 inch (19 mm) rotor pop-up sprinklers shall have an adjustable pre-assembled swing assembly riser. Swing assemblies shall be 3/4 inch x 12 inch (19 mm x 300 mm) and shall be threaded both ends. Swing assemblies shall be:
         (a) Blu-lock: Model BLJ-075-TT-12.
         (b) Rain Bird: Model TSJ-12075.
         (c) Hunter: SJ-712 12 inch (305 mm) thread.
      2) 1 inch (25 mm) inlet rotor pop-up sprinklers shall have an adjustable pre-assembled double swing joint riser. Swing joints shall be 1 inch x 12 inch (25 mm x 300 mm) and shall be threaded both ends. Swing joint riser shall be:
         (a) Rain Bird: Model TSJ-12075.
   c. Rotor Pop-Up Sprinkler Heads (Field Manufactured Assemblies):
      1) Pop-up rotor sprinkler heads shall have adjustable riser assembly, three (3) ell swing joint assembly, unless detailed otherwise on Contract Drawings:
         (a) These swing joint fittings shall be of schedule 40 PVC plastic and nipples schedule 80 gray PVC unless otherwise designated on Contract Drawings.
         (b) Horizontal nipple parallel to side of lateral line shall be 8 inches (200 mm) long minimum.
         (c) All other nipples on swing joint riser shall be of length required for proper installation of sprinkler heads.
9. Control wiring
   a. Traditional Control Wiring:
      1) Wiring
         (a) Traditional control wire shall be UF-UL listed, color coded PE insulated copper conductor direct burial size 14. For wire runs exceeding 3,300 feet (1 005.84 meter), use 12 AWG wire. Do not use green color-coded wire.
         (b) Aside from connectivity to automatic control valves, this material will be used to connect to master valve portion of hydrometer.
   b. Communication:
      1) Communication wire between controller and flow sensor portion of hydrometer to be Paige Electric PE-39 (WeatherTRAK) or PE-54 (Rain Master). Run underground communication wire in gray electrical conduit.
      2) Paige Electric Cadweld Connection.

c. Waterproof Wire Connectors:
    1) Control wire connections shall consist of properly-sized wire nut inserted in waterproof grease cap:
        (a) DBY or DBR by 3M.
        (b) 'One Step' 20111SP by King Innovation.
        (c) DB 57905, 57505 by Orbit.

10. Conduit:
    a. Exterior applications or inside mechanical shed:
        1) Galvanized IMC. Where in contact with earth or concrete, wrap galvanized IMC conduit and fittings completely with vinyl tape.
    b. Controller grounding wire conduit: commercial grade PVC Sch. 40 grey conduit.
    c. In-ground: commercial grade grey conduit.
    d. Size conduit as follows:
        1) Traditional Wiring:

| Galvanized IMC Conduit | | | | | | |
|---|---|---|---|---|---|---|
| Wire Size (AWG) | | | | | | |
| 14 | 7 | 13 | 22 | 32 | 47 | 67 |
| 12 | 6 | 8 | 18 | 25 | 38 | 59 |
| Conduit Size | 3/4 inch (9 mm) | 1 inch (25 mm) | 1 1/4 inch (32 mm) | 1 1/2 inch (38 mm) | 2 inch (50 mm) | 2 1/2 inch (64 mm) |
| PVC Schedule 40 Conduit | | | | | | |
| Wire Size (AWG) | | | | | | |
| 14 | 6 | 11 | 20 | 29 | 43 | 61 |
| 12 | 5 | 7 | 17 | 23 | 35 | 54 |
| Conduit Size | 3/4 inch (9 mm) | 1 inch (25 mm) | 1 1/4 inch (32 mm) | 1 1/2 inch (38 mm) | 2 inch (50 mm) | 2 1/2 inch (64 mm) |
| PVC Schedule 80 Conduit | | | | | | |
| Wire Size (AWG) | | | | | | |
| 14 | 5 | 9 | 17 | 24 | 39 | 55 |
| 12 | 4 | 6 | 14 | 19 | 32 | 49 |
| Conduit Size | 3/4 inch (9 mm) | 1 inch (25 mm) | 1 1/4 inch (32 mm) | 1 1/2 inch (38 mm) | 2 inch (50 mm) | 2 1/2 inch (64 mm) |

11. Valves:
    a. Manual Drain Valves:
        1) Brass ball valve with 'T' handle.
            (a) Mueller Company: MH20283NF FIP Curb Stop, 3/4 inch (19 mm).
    b. Automatic Control Valves:
        1) Rain Bird: PESB series. Provide with PRS-Dial pressure regulator if required.
    c. Isolation Valves:

1) Non-rising stem gate valve, size to match pipe size (use in cold, northern climates- eco-regions 1.0, 5.0, 6.0, 7.0, 9.1, 9.2, and 10.1).
(a) Nibco: T-113 .

d. Secondary Water Filter:
1) Amiad: Mini-Sigma 2” with 2” Matco-Norca 754N Brass Ball Valve, 2” SCH. 80 connections.
2) Enclosures (For Stand-Alone Filter):
(a) Design Criteria:
(1) Commercial grade aluminum enclosure.
(2) Sufficient in size to allow ease of access of components.
(3) Insulated in freeze susceptible areas.

e. Hydrometer (Coordinate with Section 32 8466):
1) Netafim:
(a) Provide normally closed hydrometer unless needed open for drinking fountain.
(b) HydroPoint WeatherTRAK:
(1) LHM15TG1- MEL (Low Accurate Flow Range – 1.8 GPM).
(2) LHM2TG1- MEL (Low Accurate Flow Range – 5.3 GPM).

f. Pressure Reducing Valve:
1) Secondary Water:
(a) Netafim: quick acting pressure relief valve.

g. Quick Coupling Valves and Keys:
1) Rain Bird: 33DRC, 33DLRC, 33DK with SH-O swivel.

12. Valve Accessories:
a. Valve manifolds:
1) Action Machining: 1800 Series, Models 18001, 18001-1-5, and 18001-2.0, 1, 1-1/2, and 2 inch (25, 38, and 50 mm) sizes.
2) Hydro-Rain: HRM Series.

b. Valve Boxes And Extensions:
1) Lid Colors:
(a) Green: Lawn areas (potable and secondary water).
(b) Tan: Bare soil and rock areas (potable and secondary water).
(c) Purple: Reclaimed water.
2) Carson:
(a) 12 Inch (300 mm) Model 1324-12.
(b) 12 Inch (300 mm) Model 1419-12.
(c) 10 Inch (255 mm) Model 0910.

c. Valve ID tags:
1) Christy’s: Stamped ID tag: 2.25”x2.7” yellow plastic tag with alpha-numeric labeling matching zone. Contact Christy’s for local supplier.
2) GPH Standard yellow ID Tag with alpha-numeric labeling matching zone.

d. Valve Box Supports:
1) Standard size fired clay paving bricks without holes.
2) Standard size 6 inch x 8 inch x 16 inch (150 mm x 200 mm x 400 mm) CMU Block.

13. Drip System:
a. Drip Valve Assembly (Coordinate zone size with hydrometer limits):
1) Rain Bird:
(a) 0.3 to 20 GPM: XCZ-100-PRB COM. Select screen size.
(b) 0.3 to 20 GPM: XCZ-100-PRBR. Select screen size and provide with line-size matching ball valve.
(c) 15 to 62 GPM: XCZ-150-LCS. Provide with line-size matching ball valve in separate round valve box.
(d) 15 to 62 GPM: XCZ-150-LCDR. Reclaimed water kit. Provide with line-size matching ball valve in separate round valve box.

b. Distribution Tubing (from lateral lines to emitter):
    1) Rain Bird: SPX swing pipe with barbed fittings.
c. Drip Emitters:
    1) GPH: GPST-CV Series (2, 4, 6, 8, 10 gph emitters).
d. Indicator Emitter:
    1) Tree drip indicator:
        (a) Rain Bird: XBCVPC, DBC-025 diffuser cap, TS-025 stake, and XQ 1/4 inch (6.4 mm) tubing.
e. Distribution Tubing (from lateral lines to in-line emitter tubing).
    1) Flexible polyethylene pipe.
f. In-Line Emitter Tubing:
    1) Netafim: Techline CV tubing, flush valves, and fittings.
g. Valve Boxes and Extensions:
    1) Lid Colors:
        (a) Green: Lawn areas (potable and secondary water).
        (b) Tan: Bare soil and rock areas (potable and secondary water).
        (c) Purple: Reclaimed water.
    2) Carson:
        (a) 12 Inch (300 mm) Model 1324-12.
        (b) 12 Inch (300 mm) Model 1220-12.
        (c) 12 Inch (300 mm) Model 1419-12.
        (d) 10 Inch (255 mm) Model 0910.
h. Valve ID Tags:
    1) Christy's: Stamped ID tag: 2.25"x2.7" yellow plastic tag with alpha-numeric labeling matching zone. Contact Christy's for local supplier.
    2) GPH Standard yellow ID Tag with alpha-numeric labeling matching zone.
i. Valve Box Supports:
    1) Standard size fired clay paving bricks without holes.
    2) Standard size 6 inch x 8 inch x 16 inch (150 mm x 200 mm x 400 mm) CMU Block.

14. Solvent Cement:
    a. Solvent Cement: ASTM D2564 for PVC pipe and fittings.
    b. Primer:
        1) Low VOC emissions and compliant with LEED.
        2) Product: Weld-On P-70 primer by IPS.
    c. PVC Solvent Cement:
        1) Heavy bodied, medium setting, high strength:
            (a) Low VOC emissions and compliant with LEED.
            (b) Product: Weld-On 711 Low VOC PVC Cement by IPS.
        2) Flexible, medium bodied, fast setting, high strength (flexible pipe only):
            (a) Low VOC emissions and compliant with LEED.
            (b) Product: Weld-On 795 Low VOC Flex PVC Cement by IPS.
15. Other Components:
    a. Weed Barrier:
        1) DeWitt 4.1 oz (116 g) 20 year woven polypropylene weed barrier
        2) Hanes Pro-Platinum 4.1 oz (116 g) 20 year woven polypropylene weed barrier.
    b. Recommended by Manufacturer and subject to Architect's review and approval before installation.
    c. Provide components necessary to complete system and make operational.
16. Substitutions: See Section 01 6000 - Product Requirements.
    a. Equals as approved by Landscape Architect prior to bid.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify location of existing utilities.

B. Verify that required utilities are available, in proper location, and ready for use.

C. Verify pressure.

## 3.02 PREPARATION

A. Protection:
   1. Repair or replace work damaged during course of Work at no additional cost to Owner. If damaged work is new, installer of original work shall perform repair or replacement.
   2. Do not cut existing tree roots measuring over 2 inches (50 mm) in diameter in order to install irrigation lines.

B. Surface Preparation:
   1. Location of heads and piping shown on Contract Drawings is approximate. Actual placement may vary slightly as is required to achieve full, even coverage without spraying onto buildings, sidewalks, fences, etc. Route piping to avoid plants, ground cover, and structures.
   2. During layout, consult with Architect to verify proper placement and make recommendations, where revisions are advisable.
   3. Minor adjustments in system layout will be permitted to avoid existing fixed obstructions.
   4. Include changes from Contract Documents on Record Drawings.

C. Review layout requirements with other affected work.

## 3.03 TRENCHING

A. Pulling of pipe is not permitted.

B. Trench and backfill in accordance with Sections 31 2316 and Section 31 2323.

C. Excavate trenches to specified depth. Remove rocks larger than 1-1/2 inch (38 mm) in any direction from bottom of trench. Separate out rocks larger than 1-1/2 inch (38 mm) in any direction uncovered in trenching operation from excavated material and remove from areas to receive landscaping.

D. Trench to accommodate grade changes.

E. Maintain trenches free of debris, material, or obstructions that may damage pipe.

## 3.04 GRADES AND DRAINING

A. In localities where winter shut-down is required, install piping so system can be completely drained. In addition the system should be able to be blown out with compressed air:
   1. Slope pipe to drain at control valve boxes and minimum number of low points. At these locations install:
      a. 3/4 inch (19 mm) brass ball valve for manual drain. Do not use automatic drain valves.
      b. Install 2 inch (50 mm) Class 200 PVC pipe over top of drain and cut at finish grade.
      c. Provide rubber valve cap marker.
      d. Provide one cu ft (0.03 cu m) pea gravel sump at outlet of each drain.
   2. Slope pipes under parking areas or driveways to drain outside away from them.
   3. Provide and install quick-coupling valve(s) in location for easy blowout of entire system. Install quick coupler valves with 2 lineal feet (0.60 m) minimum of galvanized pipe between valve and main line.

## 3.05 INSTALLATION

A. Install all components per manufacturer's recommendations.

B. Sleeving
   1. Sleeve water lines under walks and paving. Extend sleeves 6 inches (150 mm) minimum beyond walk or pavement edge. Cover sleeve ends until pipes and wires are installed to keep sleeve clean and free of dirt and debris.
   2. Position sleeves with respect to buildings and other obstructions so pipe can be easily removed.
   3. Follow the same directives for wiring in conduits.

C. Installation of Pipe:
   1. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.
   2. Provide for thermal movement of components in system.
   3. Connect to utilities.
   4. Unless otherwise indicated on Contract Drawings, install main lines with minimum cover of 18 inches (450 mm) based on finished grade. Install lateral lines, including those connecting drip tubing, with minimum of 12 inches (300 mm) of cover based on finish grade.
   5. Install pipe and wires under driveways or parking areas in specified sleeves 18 inches (450 mm) below finish grade or as shown on Contract Drawings.
   6. Locate pipe so no sprinkler head will be closer than 12 inches (300 mm) from building foundation.
   7. Cut plastic pipe square. Remove burrs at cut ends before installation so unobstructed flow will result.
   8. Make solvent weld joints as follows:
      a. Do not make solvent weld joints if ambient temperature is below 35 deg F (2 deg C).
      b. Clean mating pipe and fitting with clean, dry cloth and apply one (1) coat of primer to each surface.
      c. Apply uniform coat of solvent cement to outside of pipe.
      d. Apply solvent cement to fitting in similar manner.
      e. Insert pipe completely into fitting.
      f. Give pipe or fitting quarter turn to insure even distribution of solvent and make sure pipe is inserted to full depth of fitting socket.
      g. Allow joints to set at least twenty-four (24) hours before applying pressure to PVC pipe.
   9. Tape threaded connections with teflon tape.
   10. For pipe larger than 3 inches (75 mm), install joint restraints wherever change of direction occurs on PVC main lines.
   11. After piping is installed, but before heads and emitters are installed and backfilling commences, open valves and flush system with full head of water.

D. Isolation Valves:
   1. Install per plans and details.

E. Automatic Control Valves And Control Valve Wiring:
   1. Locate valve boxes within 12 inches (300 mm) to 24 inches (600 mm) of sidewalks and shrub bed edges with tops at detailed grades. Do not install more than one (1) valve in single box.
   2. Install equipment for ease of removal.
   3. Place 3 inches (75 mm) minimum of pea gravel below bricks supporting valve boxes to drain box. Set valve boxes over valve so all parts of valve can be reached for service. Set cover of valve box even with finish grade. Valve box cavity shall be reasonably free from dirt and debris.
   4. Arrange valve stations to operate in an easy-to-view progressive sequence around building. Tag valves with waterproof labels showing final sequence station assignments.

F. Wiring:
   1. Use waterproof wire connectors consisting of properly-sized wire nut and grease cap at splices and locate all splices within valve boxes.
   2. Traditional Wiring:
      a. Tape control wire to side of main line every 10 feet (3.050 m). Where control wire leaves main or lateral line, enclose it in gray conduit:
      b. Use white or gray color for common wire and other colors for all other wire. Each common wire may serve only one (1) controller.
      c. Run one (1) spare control wire from panel continuously from valve to valve throughout system similar to common wire for use as replacement if wire fails:
         1) Run spare wire to each branch of system.

2) Spare wire shall be different color than other wires. Use of green wire is not acceptable.
3) Mark spare control wire visibly within valve box as an 'Un-Connected Wire'. Extend spare control wires 24 inches (600 mm) and leave coiled in each valve box. Mark spare wire visibly within controller as 'Un-Connected Wire'.

G. Hydrometer:
1. Install as detailed and as per manufacturer's recommendations.
2. If installed on secondary system, install downstream of filter.
3. Connect communication cables to smart controller. Run cables within conduit per specification.

H. Secondary Water Filter (Secondary Water Supply Only):
1. Install 24 inches (600 mm) minimum from building elements.
2. Install in such manner so that when accessing and fully opening filter enclosure, plant material and built elements are not damaged.
3. Flush out system prior to installing device.
4. If power is required, coordinate installation with electrical.

I. Pressure Reducing Valve:
1. Install as per details and manufacturer's recommendations.

J. Sprinkler Heads And Rotor Pop-ups:
1. Set sprinkler heads and quick-coupling valves perpendicular to finish grade.
2. Do not install sprinklers using side inlets. Install using base inlets only.
3. Heads immediately adjacent to mow strips, walks, or curbs shall be one inch (25 mm) below top of mow strip, walk, or curb and have one inch (25 mm) to 3 inch (75 mm) clearance between head and mow strip, walk, or curb.
4. Set sprinkler heads at consistent distance from walks, curbs, and other paved areas and to grade by using specified components or other method demonstrated in Pre-Construction Conference.

K. Drip Assembly:
1. Install pipe providing for expansion and contraction as recommended by Manufacturer.
2. Cut tubing square and remove burrs at cut ends.
3. Distribution tubing shall be between 14 inches (350 mm) minimum and 48 inches (1 200 mm) maximum long. Layout PVC lateral lines as necessary to keep distribution tubing lengths within specified tolerances.
4. Locate drip emitter on uphill side of plant within rootball zone.
5. Layout in-line tubing for trees as indicated on Contract Drawings. Layout in-line tubing for shrubs and groundcovers so plants receive water within rootball zones.
6. Locate in-line tubing on top of soil but under weed barrier fabric and bark mulch.
7. Staple in-line tubing to ground at 3 foot (900 mm) maximum intervals and within 12 inches (300 mm) of ends and intersections.
8. Assembly Using 'Funny Pipe' Type Joints:
a. Connect distribution tubing to lateral line using barbed ell fitting.
b. Connect fitting to distribution tubing using straight barbed fitting with 1/2 inch (13 mm) threaded end.

**3.06 BACKFILL**

A. Backfill in accordance with Section 31 2323.

B. Cover both top and sides of pipe with 2 inches (50 mm) of rock-free soil or sand as specified under PART 2 PRODUCTS. Remainder of backfill to meet soil requirements as specified in Sections 32 9120 and 32 9122.

C. Do not cover pressure main, irrigation pipe, or fittings until Landscape Architect has inspected and approved system.

**3.07 FIELD QUALITY CONTROL**

A. Field inspection and testing will be performed under provisions of Section 01 4000 - Quality Requirements.
   1. Source Pressure Test:
      a. Perform source pressure test at stub-out on main water line provided for irrigation system, or at near-by fire hydrant.
      b. Notify Architect if pressures over 70 psi (480 kPA) or under 55 psi (379 kPA) are found to determine if some re-design of system is necessary before beginning work on system.
   2. System Pressure Test:
      a. By video or in the presence of Landscape Architect, pressure test main line with all valves installed.
      b. Test pressure at 100 psi (690 kPA) minimum for two (2) hours minimum.
      c. Verify there are no leaks.
      d. Receive Landscape Architect approval to proceed prior to backfilling.
      e. Following pressure test, create pressure test report.
   3. Perform Certified Water Audit if pertinent.
   4. Substantial Completion Walkthrough:
      a. Landscape Architect or designated representative(s) will inspect site and create list of non-conforming items to be resolved prior to Landscape Final Acceptance. Date on this list will act as date of Landscape Substantial Completion.
      b. Installations completed after water source has been turned off for season, as determined by Landscape Architect, will be inspected following spring after system can be checked for proper operation.
   5. Final Acceptance:
      a. Inspection, no less than thirty (30) days following substantial completion, when all work has been completed, demonstrated, and approved by Landscape Architect.
   6. Irrigation Approval
      a. Landscape Architect will approve irrigation system per Part 1 following reception of completed certified water audit (when audit is required) and when all non-conforming items have been brought into conformance.

**3.08 ADJUSTING**

A. Sprinkler Heads:
   1. Adjust sprinkler heads to proper grade when turf is sufficiently established to allow walking on it without system harm. Such lowering and raising of sprinkler heads shall be part of contract with no additional cost to Owner.
   2. Adjust sprinkler heads for proper distribution and trim so spray does not fall on building.

B. Watering Time:
   1. Adjust watering time of valves to provide proper amounts of water to plants.

**3.09 CLOSEOUT ACTIVITIES**

A. Training
   1. After system is installed and approved, instruct Owner's designated personnel in complete operation and maintenance procedures using Landscape Management Plan (LMP).
      a. Describe difference between plant establishment schedule and long-term maintenance schedule.
      b. Describe annual and regular filter maintenance.

B. Winter Shut-Down and Spring Start-Up:
   1. During first year of operation, Installer shall shut-down irrigation system prior to freezing temperatures and re-start irrigation system at beginning of growing season:
      a. Winter Shut-Down is intended to remove all potentially damaging water from irrigation system. Perform following as well as any other efforts necessary to properly winterize system:
         1) Turn off water source at point of connection.
         2) Blow out system with pressurized air, turning on each valve until water is cleared out of system. Run through system twice. Only blow out components suitable

to receive pressurized air. Hydrometers, for instance, should not be blown out. Do not use excessive air pressure that will damage pipes and parts.

3) Turn controller off or if available turn to appropriate winterization mode.
4) Open all manual drain valves.
5) Drain, wrap, protect, or remove any backflow device exposed to freezing temperatures using manufacturer's recommendations and best practices. Coordinate method with Owner's Representative.
6) Drain and remove pumps for Owner's Representative storage.
7) Drain filters using manufacturer's recommendations.
8) Check sprinkler heads to make sure they are below sidewalk and curb levels and not vulnerable to snowplow damage. Lower heads to proper elevation.

b. Spring Start-Up shall include following:
1) Close all manual valves.
2) Clean pump filters and replace if necessary.
3) Remove freeze protection as required.
4) Turn on water source at point of connection.
5) Verify that controller(s) and rain sensor are properly operating. Change battery in controller(s) and sensor(s) as required.
6) Flush entire system. Run each valve for two (2) minutes to check for damage, leaks, and coverage.
7) Repair and adjust system as needed. Fine tune heads for efficient coverage.

**END OF SECTION**

**SECTION 32 8466**
**UNDERGROUND SPRINKLERS - CONTROLLERS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Furnish and install irrigation controllers as described in Contract Documents complete with accessories necessary for proper function.

### 1.02 RELATED REQUIREMENTS:

A. Section 01 4000: 'Quality Requirements'.

B. Section 32: 8423: 'Underground Sprinklers'.

C. Section 32: 9001: 'Common Planting Requirements'.

D. Division 26: Power to controller.

### 1.03 DEFINITIONS

A. Landscape Management Plan (LMP): See Section 32 9001 for definition.

B. Plant Establishment Period: See Section 32 9001 for definition.

C. Smart Controller: Irrigation clocks that automatically adjust irrigation run times in response to environmental changes using sensors and weather information to manage watering times and frequency.

D. Two Wire Path: Conducts power to solenoid valves and also conducts communication signals from Controller to each device on system.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with other sections.

B. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 32 8423 and Section 32 9001:
      a. In addition to agenda items specified in those Sections, review following:
         1) Submittal requirements.
         2) For projects with smart controllers, review 'Smart Controller Installation Checklist' which can be accessed on the AEC website here: https://aec.churchofjesuschrist.org/aec/design_guidelines/
         3) Training Acknowledgement requirements for operation of smart controller.
         4) Review Tests and Reports for smart controllers.

### 1.05 SUBMITTALS

A. See Section 01 3000-Administrative Requirements, for submittal procedures. Submittals may be included in more than one submittal group listed below.

B. Submittals for Review:
   1. Do not commence work or deliver products to site until Landscape Architect approves submittals for review.
   2. Product Data:
      a. Manufacturer's cut sheets for each element of system.

C. Submittals for Information:
   1. Training Acknowledgement:
      a. Landscape Architect will provide certificate acknowledging training has been performed:
         1) Include name and signature of Installer, Installer's company, Installer's telephone number, and date.
         2) Include name and signature of Owner's Representative, Owner's Representative Group name, Owner's Representative Group telephone number, and date.
         3) Acknowledge Owner's Representative has been trained in operation of controller.

2. Smart Controller Checklist completed by factory approved installer.
    a. Complete and sign 'Smart Controller Installation Checklist'.
        1) Access 'Smart Controller Checklist' through:
            (a) https://aec.churchofjesuschrist.org/aec/design_guidelines/
            (b) Go to the Landscape sub-section.

D. Submittals for Project Closeout:
1. Operations And Maintenance Data (Digital Format Only):
    a. Contractor's directions for controller operation and maintenance:
        1) Winter start-up and spring shutdown,
        2) Seasonal activation and shutdown,
    b. Manufacturer Instructions:
        1) Manufacturer's printed literature on operation and maintenance of operating elements of system.
    c. Contractor's recommended run times for each valve. Include sufficient time for plants to thrive during the following periods:
        1) Plant Establishment period.
        2) Post-Plant Establishment period.
    d. Smart Controller Subscription Terms:
        1) HydroPoint WeatherTRAK:
            (a) ET subscription.
2. Record Documentation:
    a. Testing and Inspection Reports
        1) When pertinent, completed 'Smart Controller Installation Checklist'.
3. Warranty Documentation
    a. Smart Controller Warranty
        1) Manufacturer’s extended Warranty for smart controller.
    b. Automatic Controller Warranty.
4. Landscape Management Plan (LMP) In addition to items listed in 32 8423 include the following:
    a. Controller Operation and Maintenance Data
    b. Smart controller checklist.
    c. Controller warranty
    d. Controller training acknowledgment.
5. WeatherTRAK Site Map (WeatherTRAK controllers) - Use the map tool to locate the following irrigation components as applicable.
    a. Point of connection
    b. Backflow preventer
    c. Filter
    d. Pump
    e. Controller
    f. Hydrometer or equivalent
    g. Automatic valves
    h. Gate valves
    i. Quick couplers
    j. Splice boxes
    k. Grounding

E. Final payment for system authorized as per Section 32 8423.

## 1.06 QUALITY ASSURANCE

A. Regulatory Requirements:
1. General:
    a. Work and materials shall be in accordance with latest rules and regulations, and other applicable state or local laws.
    b. Nothing in Contract Documents is to be construed to permit work not conforming to these codes.

B. Qualifications:
    1. Smart Controller Installer:
        a. Manufacture approved certified installers familiar with required irrigation system and smart controller installation procedures:
            1) WeatherTRAK: Factory approved installer having completed WeatherTRAK certified contractor training (see www.weathertrak.com for details.
            2) Agree to complete reporting documents.
            3) Agree to instruct Owner's designated personnel in complete operation and maintenance of smart controller.
            4) Agree to assist Landscape Architect in completing Watering Schedule for Landscape Management Plan (LMP).
    2. Controller Installer:
        a. Irrigation Subcontractor
            1) Company specializing in performing work of this section.
            2) Minimum five (5) years experience in irrigation sprinkler installations.
            3) Minimum five (5) satisfactorily completed irrigation sprinkler installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
            4) Use trained personnel familiar with required irrigation sprinkler procedures and with Contract Documents.
            5) Foreman or supervisor required to attend pre-installation conference.
        b. Irrigation Installer
            1) Perform installation under direction of foreman or supervisor.
            2) Minimum three (3) years experience in irrigation sprinkler installations similar in size, scope, and complexity.
    3. Submit documentation upon request.

C. Testing and Inspection.
    1. Owner will provide Certified Water Audit as specified in Section 32 8423:

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
    1. Protect materials from damage and prolonged exposure to sunlight.

## 1.08 WARRANTY

A. Warranty:
    1. Smart Controller:
        a. Provide Manufacturer's extended warranty for five (5) years to be free of design, materials, and workmanship defects.

# PART 2 PRODUCTS

## 2.01 SYSTEM

A. Manufacturers:
    1. HydroPoint Data Systems, Inc., Petaluma, CA www.hydropoint.com.

B. Approved Distributors:
    1. HydroPoint Data Systems, Inc. (Weather/TRAK) Petaluma, CA www.hydropoint.com.
        a. For CA, AZ, NV, TX, NM, CO, NC, NY, NJ, OR, and WA contact:
            1) Charles Zaher (707) 338-7029, czaher@hydropoint.com.
        b. Utah (and all other states) contact:
            1) Sprinkler Supply - West Jordan, UT, Joe Jackson (801) 404-1371 (801) 566-8172 joe@sprinklersupplyco.com.

C. Smart Controllers:
    1. HydroPoint WeatherTRAK:
        a. Traditional Wiring option:
            1) Model WTL-C-6-PL-F (6 stations or less).
            2) Model WTL-C-12-PL-F (12 stations or less).

3) Model WTL-C-18-PL-F (18 stations or less).
4) Model WTPRO3-C-xx-CWM (18 stations or more).

b. Inspection of system.
c. Vandal resistant powder coated steel finish suitable for either indoor or outdoor environments. Provide stainless steel where outdoor conditions require non-corrosive material.
d. Wall mounted enclosure assembly.
e. Key-Lock.
f. Low Profile Antenna.
g. Universal Radio remote interface.
h. One (1) year ET subscription.
i. On-site post-installation controller inspection and start-up by authorized service provider.
j. Site consultation (For O&M and R&I projects).
k. All other components required for complete and operational system.

D. Automatic Rain Sensors:
1. Hunter: MINI-CLIK, WRC, WRFC (Do not use with WeatherTRAK systems)
2. Hydro-Rain: HRC-100-RS-RF (wireless); HRC-100-RS-HW (wired)
3. Rain Bird: WR2-RFC, WR2-48
4. Toro: TWRS (wireless) or Irritrol RFS-1000 (wireless)
5. Weathermatic: 955 Rain Sense

E. Hydrometer: See Section 32 8423.

F. Other Components:
1. Recommended by Manufacturer and subject to Landscape Architect's review and approval before installation.
2. Provide components necessary to complete system and make operational.

**PART3 EXECUTION**

**3.01 PREPARATION**

A. Protection:
1. Protection Of In-Place Conditions:
a. Repair or replace work damaged during course of Work at no additional cost to Owner. If damaged work is new, installer of original work shall perform repair or replacement.
b. Do not cut existing tree roots measuring over 2 inches (50 mm) in diameter in order to install irrigation lines or components.

**3.02 INSTALLATION**

A. Controllers:
1. Install as detailed and as per manufacturer’s recommendations.
2. In hot climates, install out of sun exposure.
3. Install grounding as per Manufacturer's recommendations:
a. Note: if controller is mounted within building, coordinate grounding with Electrical Engineer.
4. Install automatic rain sensor as per Manufacturer's recommendations.

B. Smart Controller:
1. Complete 'Smart Controller Installation Checklist' referenced in this specification during installation of Controller.
2. Install communication connections as required: Wireless or ethernet.

**3.03 FIELD QUALITY CONTROL**

A. Field Tests and Inspections:
1. Verify controllers are fully operational and installed per manufacturer’s recommendations.
2. Smart Controller Testing:

a. Use ‘Smart Controller Installation Checklist’ or 'Manufacturer's Operational Report' to test system to verify following:
1) Verify all aspects of smart controller installation checklist or 'Manufacturer's Operational Report' are complete.
2) Verify controller is installed correctly and will automatically adjust irrigation run times in response to environmental changes using sensor and weather information to manage watering times and frequency.
3) Sign 'Smart Controller Installation Checklist' to be included in Closeout Submittals.

3. Substantial Completion Walkthrough. See Section 32 8423.
4. Irrigation Approval. See Section 32 8423.

B. Non-Conforming Work: Non-conforming work as covered in General Conditions applies, but is not limited to following:
1. Underground Sprinkler System:
a. Correct any work found defective or not complying with Contract Document requirements at no additional cost to Owner.

**3.04 ADJUSTING**

A. Watering Time:
1. Adjust zone watering times to provide proper amounts of water to plants.

**3.05 CLOSEOUT ACTIVITIES**

A. Training:
1. After system is installed and approved, instruct Owner's designated personnel in complete operation and maintenance procedures using Landscape Management Plan (LMP).
a. Describe difference between plant establishment schedule and post plant establishment schedule.

B. Smart Controller Training:
1. Manufacturer’s approved Distributor to instruct Owner's designated personnel in complete operation and maintenance of smart controller.
2. Manufacturer’s approved Distributor to review terms of Warranty, Maintenance procedures and contact information with Owner's Representative.
3. For WeatherTRAK controllers, demonstrate completion of map tool.

**END OF SECTION**

**SECTION 32 9001**
**COMMON PLANTING REQUIREMENTS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Common procedures and requirements for landscaping work.
   2. Provide maintenance for new landscaping as described in Contract Documents.

B. Related Requirements:
   1. Pre-Installation conferences held jointly with Section 32 9001 as described in Administrative Requirements on Part 1 of this specification section:
   2. Section 01 4000: 'Quality Assurance – Qualifications'.
   3. Section 31 0500: ‘Common Earthwork Requirements’.
   4. Section 31 1000: ‘Clearing and Grubbing’.
   5. Section 31 1413: ‘Topsoil Stripping And Stockpiling’.
   6. Section 31 2000: ‘Grading’.
   7. Section 31 2316: ‘Excavation’.
   8. Section 31 2323: ‘Fill’.
   9. Section 32 8423: 'Underground Sprinklers'.
   10. Section 32 9120: ‘Topsoil And Placement’.
   11. Section 32 9122: ‘Topsoil Grading’.
   12. Section 32 9219: 'Seeding'.
   13. Section 32 9223: 'Sodding'.
   14. Section 32 9300: 'Plants'.

### 1.02 REFERENCES

A. Definitions:
   1. Landscape Management Plan (LMP): LMP is an Owner’s Representative’s quick reference maintenance document. It combines elements from Irrigation Sections 32 8000 and Planting Sections 32 9000. The LMP document is created from Operations and Maintenance Data, Warranty Documentation, and Record Documentation. This is a digital format only document. Deliver to Church Headquarters for inclusion in "as-built" catalog. Send to mfd-asbuilt@churchofjesuschrist.org. Access sample LMP through Landscape Resources Website located at:
      a. https://aec.churchofjesuschrist.org/aec/landscape/.
   2. Landscape Final Acceptance: Inspection, no less than (30) days following substantial completion, when all work has been completed, demonstrated, and approved by the Landscape Architect. Coordinate with 32 8000 and 32 9000 Sections.
   3. Plant Establishment Period: Time required for plants to successfully develop root systems into surrounding soil. Following this period, irrigation run times are typically modified. For purposes of this contract, the plant establishment period is one (1) year from date of Substantial Completion.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with other Sections.

B. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference and held jointly with following sections:
      a. Section 32 8423: 'Underground Sprinklers'.
      b. Section 32 9120: ‘Topsoil And Placement’.
      c. Section 32 9122: ‘Topsoil Grading’.
      d. Section 32 9223: 'Sodding'.
      e. Section 32 9300: 'Plants'.
   2. In addition to agenda items specified in Section 01 3000, review the following:
      a. Site Visits:

1) Landscape Architect to visit site five (5) times during project construction.
2) If site conditions necessitate additional visits, Landscape Architect can schedule addition site visits with approval from Architect.
3) During construction, addition site visits may be approved in writing by Architect or Owner for special considerations before commencement.
4) Site visits caused by lack of work progress by Landscape Subcontractor shall be reimbursed to Landscape Architect by Landscape Subcontractor for the amount determined by Architect and Owner for additional site visits.

b. Coordination:
1) Landscape Subcontractor and Landscape Architect to coordinate site visits and include Architect and General Contractor in communications.

c. Landscape Maintenance:
1) Establish responsibility for maintenance of new landscaping during all phases of construction period.

d. Percolation Test:
1) Discuss percolation test requirements per Section 32 9300.

e. Review additional agenda items as specified in related sections listed above.

3. Approved Site Visits:
a. Site Visit No. 1:
1) Description:
(a) Landscape pre-installation Conference.
2) Schedule: Conduct pre-installation conference after completion of Finish Grading specified in Section 31 0500 and (1) week minimum before beginning landscape work.
3) Required Attendees:
(a) Project Manager, Facilities Manager, Architect, General Contractor, Landscape Subcontractor, Excavator, and Landscape Architect.
(b) Include Landscaping Subcontractor Foreman and those responsible for installation of landscaping to be in attendance.
4) Related Sections:
(a) Section 31 0500: 'Common Earthwork Requirements'.
(b) Section 32 8423: 'Underground Sprinklers: No Controllers'.
(c) Section 32 8466: 'Underground Sprinklers: Controllers'.
(d) Section 32 9120: ‘Topsoil And Placement’.
(e) Section 32 9122: ‘Topsoil Grading’.
(f) Section 32 9223: 'Sodding'.
(g) Section 32 9300: 'Plants'.
5) Notes:
(a) Verify project site conditions and review scope of work before installation begins.
(b) Verify appropriate sub-grades have been established.

b. Site Visit No. 2:
1) Description:
(a) Irrigation system pressure test compliance, main line inspection, valve inspection.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning irrigation system pressure test.
3) Required Attendees:
(a) General Contractor, Landscape Subcontractor, Landscape Architect.
4) Recommended Attendees:
(a) Project Manager, Facilities Manager.
5) Related Sections:
(a) Section 32 8423: 'Underground Sprinklers'.
(b) Section 32 9120: ‘Topsoil And Placement’.
(c) Section 32 9122: ‘Topsoil Grading’.

6) Notes:
(a) Verify finish grading in preparation for planting.

c. Site Visit No. 3:
1) Description:
(a) Inspect and approve plant quality, plant quantity, plant pits, plant pit backfill, planting depths, and removal of packaging/distribution materials, wire, and ties.
2) Schedule: Conduct site visit one (1) week minimum after notification from Contractor before beginning site visit no. 3.
3) Required Attendees:
(a) General Contractor, Landscape Subcontractor, Landscape Architect.
4) Recommended Attendees:
(a) Project Manager, Facilities Manager.
5) Related Sections:
(a) Section 32 9300: 'Plants'.
6) Notes:
(a) Inspect irrigation system installation, inspect weed barrier fabric.

d. Site Visit No. 4:
1) Description:
(a) Comprehensive Substantial Completion inspection prior to beginning thirty (30) day Landscape Subcontractor maintenance period.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning site visit no. 4.
3) Required Attendees:
(a) Project Manager, Facilities Manager, Architect, General Contractor, Landscape Subcontractor, Landscape Architect.
4) Related Sections:
(a) Section 32 8423: 'Underground Sprinklers'.
(b) Section 32 9300: 'Plants'.
5) Notes:
(a) Verify contract requirements have been followed including but not limited to: planting compliance, irrigation system coverage and irrigation system operation.

e. Site Visit No. 5:
1) Description:
(a) At the end of thirty (30) day Landscape Subcontractor maintenance period, verify deficient items have been corrected and verify no others exist.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning site visit no. 5.
3) Required Attendees:
(a) Project Manager, Facilities Manager, Architect, General Contractor, Excavation Subcontractor, Landscape Subcontractor, Landscape Architect.
4) Related Sections:
(a) Section 32 8423: 'Underground Sprinklers'.
(b) Section 32 9300: 'Plants'.
5) Notes:
(a) Review Landscape Management Plan (LMP) with Owner's Representative. Provide landscape maintenance training.

**1.04 SUBMITTALS**

A. See Section 01 3000-Administrative Requirements, for submittal procedures. Submittals may be included in more than one submittal group listed below.

B. Submittals for Information:
1. Establishment Period Acknowledgement:

a. Landscape Architect will provide acknowledgment of Establishment Period commencement:
    1) Certificate will include name and signature of Contractor, Contractor's company, Contractor's telephone number, and date.
    2) Certificate will include name and signature of Owner's Representative, Owner's Representative's Group name, Owner's Representative Group telephone number, and date.
    3) Certificate will acknowledge date when Establishment Period begins and that it extends one (1) year from that time.

C. Submittals for Project Closeout:
1. Operations and Maintenance Data:
    a. Landscape maintenance recommendations.
    b. Individual plant maintenance recommendations.
    c. Plant establishment maintenance recommendations.
    d. Post-plant establishment maintenance recommendations.
2. Record Documentation:
    a. Landscape Drawings:
        1) As installation occurs, prepare accurate record drawings. Submit electronic copy prior to final inspection. Drawing shall include:
            (a) Detail and dimension changes made during construction.
            (b) Take dimensions from permanent constructed surfaces or edges located at or above finish grade.
3. Landscape Warranty - See Section 32 9300.
4. Landscape Management Plan (LMP):
    a. Landscape Section. Include the following:
        1) Operations and Maintenance Data:
        2) Record Documentation including Landscape Drawings.
        3) Landscape Warranty
        4) Establishment Period Acknowledgement

## 1.05 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Herbicides:
    a. Products shall be recognized for intended use by AHJ.
2. Invasive and Non-native plants:
    a. Comply with all applicable laws governing invasive and non-native plants.

B. Installer Qualifications:
1. Landscape Subcontractor. Requirements of Section 01 4301 applies, but not limited to following:
    a. Company specializing in performing work of this section.
    b. Minimum five (5) years' experience in landscaping installations.
    c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
    d. Upon request, submit documentation.
2. Installer:
    a. Planting shall be performed under direction of foreman or supervisor with minimum three (3) years' experience in landscape installations similar in size, scope, and complexity.
    b. Foreman or supervisor required to attend pre-installation conference.
    c. Use trained personnel familiar with required planting procedures and with Contract Documents.
3. Submit documentation upon request.

## 1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:

1. Deliver packaged materials in containers showing weight, analysis, and name of Manufacturer.
2. Deliver sod, plants, trees, and shrubs in healthy and vigorous condition.
3. Protect materials from deterioration during delivery.

B. Storage And Handling Requirements:
1. Store in location on site where they will not be endangered and where they can be adequately watered and kept in healthy and vigorous condition.
2. Protect materials from deterioration while stored at site.

**PART 2 PRODUCTS – NOT USED**

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verification Of Conditions:
1. Inspect site and Contract Documents to become thoroughly acquainted with locations of irrigation, ground lighting, and utilities.

**3.02 PREPARATION**

A. Before proceeding with work, verify dimensions and quantities. Report variations between Drawings and site to Architect before proceeding with landscape work.
1. Plant totals are for convenience of Contractor only and are not guaranteed. Verify amounts shown on Drawings.
2. All planting indicated on Contract Documents is required unless indicated otherwise.

B. Protection:
1. Mitigate or eliminate if possible conditions that will create hazards. Post signs or barriers as required.
2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.
3. Keep site well drained and landscape excavations dry.

**3.03 INSTALLATION**

A. Interface With Other Work:
1. Do not plant trees and shrubs until major construction operations are completed. Do not commence landscaping work until work of Section 31 2216 and Section 32 8423 has been completed and approved.

B. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

C. Hand excavate as required.

D. Maintain grade stakes until parties concerned mutually agree upon removal.

E. When conditions detrimental to plant growth are encountered, such as rubble fill or adverse drainage conditions, notify Architect before planting.

**3.04 FIELD QUALITY CONTROL**

A. Field Inspection:
1. Landscape Architect will inspect landscaping installation for Substantial Completion.

B. Non-Conforming Work. Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
1. Replace damaged plantings within (10) days of notification at no additional cost to Owner.
2. Repair damage to irrigation, ground lighting, utilities, paving, concrete curb and gutters and other items adjacent to landscaping caused by work of this Section or replace at no additional cost to Owner.

**3.05 CLEANING**

A. Waste Management:
1. Immediately clean up soil or debris spilled onto pavement and dispose of deleterious materials.

## 3.06 CLOSEOUT ACTIVITIES

A. Instruction to Owner:
   1. Include following training:
      a. Review Landscape Management Plan (LMP):
         1) Review maintenance recommendations.
      b. Review Maintenance as specified at the end of this specification.
   2. Establishment Period Acknowledgement (coordinate with 32 8000 section(s)):
      a. Landscape Architect will acknowledge Establishment Period commencement.

## 3.07 PROTECTION

A. Protect planted areas against traffic or other use immediately after planting is completed by placing adequate warning signs and barricades.

B. Provide adequate protection of planted areas against trespassing, erosion, and damage of any kind. Remove this protection after Architect has accepted planted areas.

## 3.08 MAINTENANCE

A. General:
   1. Before beginning maintenance period, plants shall be in at least as sound, healthy, vigorous, and in approved condition as when delivered to site, unless accepted by Architect in writing at final landscape inspection.
   2. Maintain landscaping for thirty (30) continuous days minimum after Substantial Completion. If maintenance period is interrupted by non-growing season or irrigation winter shut-down, begin maintenance period after start of growing season as agreed with Architect, and continue one (1) continuous month therefrom.
   3. Replace landscaping that is dead or appears unhealthy or non-vigorous as directed by Landscape Architect before end of maintenance period. Make replacements within ten (10) days of notification. Lawn being replaced shall be guaranteed and maintained an additional thirty (30) days from date of replacement.

B. Sodded Lawn:
   1. Maintain sodded lawn areas until lawn complies with specified requirements and throughout maintenance period.
   2. Water sodded areas in sufficient quantities and at required frequency to maintain sub-soil immediately under sod continuously moist 3 to 4 inches (75 to 100 mm) deep.
   3. Cut grass first time when it reaches 3 inches (75 mm) high. Continue to mow at least once each week throughout maintenance period. Remove clippings.
   4. Apply herbicide as necessary to maintain weed-free lawn. Apply herbicide in accordance with manufacturer's instructions during calm weather when air temperature is between 50 and 80 deg F (10 and 27 deg C).
   5. At end of thirty (30) day maintenance period, fertilize lawns as recommended in Section 32 9122.

C. Trees, Shrubs, And Plants:
   1. Maintain by pruning, cultivating, and weeding as required for healthy growth.
   2. Restore planting basins.
   3. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical positions as required.
   4. Spray as required to keep trees and shrubs free of insects and disease.
   5. Provide supplemental water by hand as needed in addition to water from sprinkling system.

**END OF SECTION**

**SECTION 32 9120**
**TOPSOIL AND PLACEMENT**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Perform topsoil evaluation and placement required prior to topsoil grading as described in Contract Documents.

B. Related Requirements:
   1. Section 31 0500: 'Common Earthwork Requirements':
   2. Section 31 1413: 'Topsoil Stripping And Stockpiling'.
   3. Section 31 2200: ‘Grading’.
   4. Section 32 9001: 'Common Planting Requirements':
   5. Section 32 9122: ‘Topsoil Grading’.

### 1.02 REFERENCES

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 32 9001.
   2. In addition to agenda items specified in Section 01 3100 and Section 32 9001, review following:
      a. Review finish grade elevation and tolerance requirements.
      b. Review surface preparation requirements including disking, tilling, ripping, or aerating.
      c. Review Attachment 'Topsoil Testing Report' including:
         1) Landscape Architect, Contractor, Testing, and Soil Testing Laboratory Instructions.
      d. Review Field Quality Control testing requirements for 'Topsoil Testing Report' including:
         1) Corrections required for topsoil not meeting requirements of this specification.
         2) Approval requirement of ‘Topsoil Testing Report’ by Landscape Architect.
         3) Submittals required as identified in Closeout Submittals.

### 1.04 SUBMITTALS

A. See Section 01 3000-Administrative Requirements, for submittal procedures. Submittals may be included in more than one submittal group listed below.

B. Submittals for Review:
   1. Do not commence work or deliver products to site until Landscape Architect approves submittals for review.
   2. Testing And Evaluation Reports:
      a. Completed ‘Topsoil Testing Report’. Follow testing directives of Part 3 of this specification.
         1) Access 'Topsoil Testing Report' template through:
            (a) https://aec.churchofjesuschrist.org/aec/design_guidelines/
            (b) Go to the Landscape sub-section.
         2) Owner will pay for one (1) final test.
         3) Additional test(s) if necessary will be paid by Contractor.
      b. Submit report stating location of imported topsoil source and describe recent use(s).

C. Submittals for Information
   1. Submit delivery slips indicating amount of topsoil delivered to Project site.

D. Submittals for Project Closeout:
   1. Record Documentation:
      a. Final Landscape Architect approved ‘Topsoil Testing Report’.
      b. Imported topsoil source and recent use as described above.

2. Landscape Management Plan (LMP):
    a. Landscape Section. Include the following:
        1) 'Topsoil Testing Report'.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Topsoil:
    1. Design Criteria:
        a. Topsoil used in landscaped areas, whether imported, stockpiled, or in place, shall be weed free, fertile, loose, friable soil meeting following criteria:
            1) Chemical Characteristics:
                (a) 5 to 8.0.
                (b) Soluble Salts: less than 3.0 mmhos/cm.
                (c) Sodium Absorption Ratio (SAR): less than 6.0.
                (d) Organic Matter: greater than one percent.
            2) Physical Characteristics:
                (a) Gradation as defined by USDA triangle of physical characteristics as measured by hydrometer.
                (b) Sand: 15 to 60 percent.
                (c) Silt: 10 to 60 percent.
                (d) Clay: 5 to 30 percent.
                (e) Clean and free from toxic minerals and chemicals, noxious weeds, rocks larger than or equal to 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.
                (f) Soil (Coordinate screening as specified in Section 31 1413 'Topsoil Stripping And Stockpiling' to meet these characteristics):
                (g) Soil shall not contain more than five (5) percent by volume of rocks measuring over 1/4 inch (6 mm) in largest size.
                (h) Soil shall be topsoil in nature.
                (i) Soil resembling road base or other like materials are not acceptable.
    2. Project Topsoil Requirements:
        a. It is anticipated that the following percentages of material will be required to meet Project site topsoil requirements:
            1) Imported Topsoil: __100%__ percent of landscape area:
                (a) Lawn Areas: __6%__ percent of imported topsoil.
                (b) Shrub / Tree Areas: __94%__ percent of imported topsoil.
                (c) Native Grass / Shrub / Tree Areas: __0%__ percent of imported topsoil.
            2) Stockpiled Topsoil: __0%__ percent of landscape area:
                (a) Lawn Areas: __N/A__ percent of stockpiled topsoil.
                (b) Shrub / Tree Areas: __N/A__ percent of stockpiled topsoil.
                (c) Native Grass / Shrub / Tree Areas: __N/A__ percent of stockpiled topsoil.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verification Of Conditions:
    1. Do not commence work of this Section until grading tolerances specified in Section 31 2200 are met.
    2. Do not commence work of this Section until coordination with Section 32 9122 'Topsoil Grading'.
    3. Receive approval from Landscape Architect of subgrade elevations prior to commencement of this Work.

### 3.02 PREPARATION

A. Protection Of In-Place Conditions:
    1. Protect utilities and site elements from damage.

B. Surface Preparation:
   1. Surfaces to receive Imported and Stockpiled Topsoil:
      a. Disk, till, rip, or aerate with approved agricultural aerator to depth of 6 inches (150 mm).
      b. Place specified and approved topsoil on prepared surface.

## 3.03 PERFORMANCE

A. General:
   1. After Surface Preparation requirements are completed, limit use of heavy equipment to areas no closer than 6 feet (1.80 meter) from building or other permanent structures. Use hand held tillers for preparation of subsoil in areas closer than 6 feet (1.80 m).
   2. Do not disturb existing shrub or tree roots to remain.

B. Topsoil Depth/Quantity:
   1. Total topsoil depth of 5 inches (125 mm) minimum in lawn and groundcover planting areas.
   2. No topsoil as defined in this Section is required over tree and shrub planting areas or native grass, shrub, or tree areas as long as what is in place is not excessively rocky or otherwise unfavorable to healthy plant growth.
   3. Provide no less than quantity required to achieve tolerance described in Section 32 9122 'Topsoil Grading' along with additional soil amendments required. Installer of this section responsible for providing sufficient topsoil material.

C. Imported Topsoil:
   1. Place tested and approved topsoil:
      a. Before placing topsoil, remove organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.
      b. Do not place topsoil whose moisture content makes it prone to compaction during placement process.
      c. Do not place topsoil when subgrade is either wet or frozen enough to cause clodding.

D. Stockpiled Topsoil:
   1. Redistribute tested and approved existing topsoil stored on site as result of work of Section 31 1413 'Topsoil Stripping And Stockpiling'.
      a. Before placing topsoil, remove organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.
      b. Do not place topsoil whose moisture content makes it prone to compaction during placement process.
      c. Do not place topsoil when subgrade is either wet or frozen enough to cause clodding.

E. In Place Topsoil:
   1. At locations where topsoil can remain in place and has been tested and approved, perform the following:
      a. Remove existing vegetation as required in preparation for new landscaping.
      b. Remove vegetative layer, roots, organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.

F. Grading:
   1. Slope grade away from building for 12 feet (3.60 m) minimum from walls at slope of 1/2 inch in 12 inches (13 mm in 300 mm) minimum unless otherwise noted.
      a. High point of finish grade at building foundation shall be 6 inches (150 mm) minimum below finish floor level.
      b. Direct surface drainage in manner indicated on Contract Documents by molding surface to facilitate natural run-off of water.
      c. Fill low spots and pockets with topsoil and grade to drain properly.

## 3.04 FIELD QUALITY CONTROL

A. Testing And Inspections:
   1. Topsoil Testing:
      a. Test topsoil for project suitability using Section 1 described ‘Topsoil Testing Report’:

1) Testing requirements:
   (a) If testing report shows topsoil does not meet topsoil Design Criteria (Section 2) and Topsoil Testing Report, 'Soil Test Data' and 'Rocks' requirements, topsoil is non-conforming. Corrections and re-testing are required until topsoil meets requirements.
   (b) Use new 'Topsoil Testing Report', each time topsoil is tested.
   (c) After topsoil is approved by Landscape Architect, submit final 'Topsoil Testing Report as specified in Part 1 'Submittals'.

B. Non-Conforming Work:
   1. If topsoil does not meet topsoil Design Criteria and 'Topsoil Testing Report: Soil Test Data' requirements topsoil will be re-tested at no cost to Owner.
      a. Correction procedures:
         1) Topsoil not meeting specified physical characteristics of sand, silt, and clay shall be removed from site.
         2) Topsoil not meeting specified organic or fertility specifications may be amended in place with materials recommended in Topsoil Testing Report.
         3) If amendments are necessary, submit proposed amendments and application rates required to bring topsoil up to minimum specified requirements.
         4) Re-test topsoil and remove and amend as required until it meets minimum specified requirements.
      b. Submit report to Landscape Architect for approval.
      c. Receive approval from Landscape Architect prior to planting.

**END OF SECTION**

**SECTION 32 9122**
**TOPSOIL GRADING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Perform topsoil grading required to prepare site for installation of landscaping as described in Contract Documents.
   2. Perform topsoil placement and finish grading work required to prepare site for installation of landscaping as described in Contract Documents.
   3. Furnish and apply soil amendments as described in Contract Documents.

B. Related Requirements:
   1. Section 31 0500: ‘Common Earthwork Requirements’:
   2. Section 31 1413: ‘Topsoil Stripping And Stockpiling’.
   3. Section 31 2200: ‘Grading’.
   4. Section 32 9001: 'Common Planting Requirements':
      a. Pre-installation conference held jointly with other common planting related sections.
   5. Section 32 9120: ‘Topsoil And Placement’.

### 1.02 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 32 9001.
   2. In addition to agenda items specified in Section 01 3000, review the following:
      a. Review compost requirements to be within acceptable range as per Attachment 'Compost Quality Guidelines For Landscaping' and 'Compost Verification Report' in this specification.
      b. Review soil fertility amendments and fertilizer requirements as per Attachment 'Topsoil Testing Report' in Section 32 9120.

### 1.03 SUBMITTALS

A. See Section 01 3000-Administrative Requirements, for submittal procedures. Submittals may be included in more than one submittal group listed below.

B. Submittals for Review:
   1. Do not commence work or deliver products to site until Landscape Architect approves submittals for review.
   2. Product Data:
      a. Soil Amendments and Fertilizer:
         1) Soil amendment and fertilizer literature and chemical / nutrient analysis.
         2) Proposed application rates necessary to bring topsoil up to specified requirements.
         3) Product source location.
   3. Samples:
      a. Soil Amendments and Conditioners:
         1) 2.5 lb sample for each product delivered in resealable plastic bag(s).
   4. Testing And Evaluation Reports:
      a. ‘Compost Verification Report’:
         1) Signed copy certifying compost meets requirements of this specification
            (a) Access 'Compost Verification Template' through:
               (1) https://aec.churchofjesuschrist.org/aec/design_guidelines/
               (2) Go to the Landscape sub-section.

C. Submittals for Information:
   1. Soil Fertility Amendments and Fertilizer:
      a. Upon request submit delivery slips indicating amount of soil amendments, compost, conditioner, and fertilizer delivered to Project site.

D. Submittals for Project Closeout:
    1. Landscape Management Plan (LMP):
        a. Landscape Section. Include the following:
            1) Signed final Compost Verification Report.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

A. Soil Amendments:
    1. Incorporate following soil amendments into topsoil used for Project:
        a. Acceptable Soil Amendments, Soil Conditioners, And Application Rates. (Choose one):
            1) Soil Pep'.
            2) 'Compost'
            3) Other amendments and conditioners as specified by 'Topsoil Testing Report' such as lime, gypsum, Axis, etc.
            4) Substitutions: See Section 01 6000-Product Requirements.
                (a) Equal as approved by Landscape Architect prior to bid.
        b. Acceptable Fertilizers And Application Rates:
            1) As specified by Topsoil Testing Report

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verification Of Conditions:
    1. Do not commence work of this Section until imported, stockpiled and in place topsoil are placed as specified in Section 32 9120 'Topsoil And Placement'.

**3.02 PREPARATION**

A. Protection Of In-Place Conditions:
    1. Protect utilities and site elements from damage.

B. Surface Preparation:
    1. Surfaces that meet specified topsoil elevations.
        a. Seven (7) days maximum before beginning seeding and planting:
            1) Loosen topsoil 6 inch (150 mm) deep, dampen thoroughly, and cultivate to properly break up clods and lumps.
            2) Rake area to remove clods, rocks, weeds, roots, debris or other material 1-1/2 inches (38 mm) or more in any dimension.
            3) Grade and shape landscape area to bring surface to true uniform planes free from irregularities and to provide drainage and proper slope to catch basins.
    2. Addition of Soil Amendments:
        a. Add specified soil amendments at specified rates to topsoil as directed by Topsoil Testing Report found in Section 32 9120 'Topsoil And Placement'.
        b. Add specified fertilizers at specified rates into topsoil as directed by Soil Testing Laboratory.
        c. Roto-till or otherwise mix soil amendments evenly into topsoil.
        d. Incorporate and leach soil amendments which require leaching, such as gypsum, within such time limits that soil is sufficiently dry to allow proper application of fertilizer and soil conditioners.

**3.03 PERFORMANCE**

A. General:
    1. Limit use of heavy equipment to areas no closer than 6 feet (1.80 meter) from building or other permanent structures. Use hand held tillers for preparation of subsoil in areas closer than 6 feet (1.80 m).
    2. Do not expose or damage existing shrub or tree roots.

B. Finish Grade Tolerances (As shown on General Planting Details in Contract Documents):

1. Finish topsoil grade of planting areas before planting and after addition of soil additives shall be specified distances below top of adjacent pavement of any kind:
    a. Ground Cover Areas: 2 inches (50 mm) below.
    b. Seeded Areas: One inch (25 mm) below.
    c. Sodded Areas: 2 inches (50 mm) below.
    d. Tree and Shrub Areas (not individual trees): 4 inches (100 mm) below.

C. Placed Topsoil:
1. At locations where topsoil has been placed as per Section 32 9120 'Topsoil And Placement', perform the following:
    a. Remove existing vegetation as required in preparation for new landscaping.
    b. Remove organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.

D. Grading:
1. Coordinate grading as described in Section 32 9120 'Topsoil And Placement'.

E. Immediately before planting lawn and with topsoil in semi-dry condition, roll areas that are to receive lawn in two directions at approximately right angles with water ballast roller weighing 100 to 300 lbs (45 to 135 kg), depending on soil type.

F. Rake or scarify and cut or fill irregularities that develop as required until area is true and uniform, free from lumps, depressions, and irregularities.

## 3.04 PROTECTION

A. After landscape areas have been prepared, take no heavy objects over them except lawn rollers.

**END OF SECTION**

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**SECTION 32 9219**
**SEEDING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install seeded lawn as described in Contract Documents.

### 1.02 RELATED REQUIREMENTS

A. Section 32 8423: Irrigation System - No Controllers.

B. Section 32 8466: Irrigation System - Controllers

C. Section 32 9001: 'Common Planting Requirements':
   1. Pre-installation conference held jointly with other common planting related sections.

D. Section 32 9120: ‘Topsoil And Placement’.

E. Section 32 9122: ‘Topsoil Grading’.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with other Sections.

B. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 32 9001.

### 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Submittals for Review
   1. Do not commence work or deliver products to site until Landscape Architect approves submittals for review.
   2. Seed Certification
      a. Written certification confirming lawn seed mix and quality:
         1) Include all species used.
         2) Include percent germination.
         3) Include percent weed seed.
         4) Include name and contact information of supplier.

C. Submittals for Closeout:
   1. Operations and Maintenance Data:
      a. Seed Certification.
   2. Landscape Management Plan (LMP):
      a. Landscape Section:
         1) Seed Certification.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Approval Requirements:
   1. Deliver seed in original sealed, labeled, and undamaged containers.
   2. Label will show shelf life or seed harvest date.
   3. Label display seed mixture.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Seed:
   1. Type and mix shown on Drawings.
   2. Provide minimum three (3) seed varieties. Varieties should include the following attributes:
   3. Seed Grade: Certified Turf Quality.
   4. Application Rate: 2.5 lbs/1000 sf (1.134 kg/93 sq m). *Revise as needed based on seed.*

5. Purchase seeds that bear this season's certification of weight, purity, and germination from reputable seed company.

B. Top Dressing for Seeding:
   1. Peat moss.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Interface With Other Work:
   1. Do not commence work of this Section until work of Sections 32 9122 and 32 9300 has been completed and approved.

B. Tolerances:
   1. Final grade of soil after seeding of lawn areas is complete shall be one inch (25 mm) below top of adjacent pavement of any kind.

C. Seeding:
   1. After lawn areas are graded, sow seed evenly at specified rate with adequate equipment at time when little or no wind is blowing.

D. Top Dressing:
   1. After seeding, rake or broom seed in gently and roll area to firm in seed.
   2. Peat moss:
      a. After rolling, cover area evenly with top dressing of peat moss at rate of two (2) 4 cu ft (0.1132 cu m) bales per 1,000 sq ft (93 sq m) of area.

E. After Top Dressing:
   1. Thoroughly water seeded areas.
   2. Reseed areas that do not show prompt germination at fifteen (15) day intervals until an acceptable stand of grass is assured.

**3.02 FIELD QUALITY CONTROL**

A. Field Inspection:
   1. Seeded areas will be accepted at Project closeout if:
      a. Seeded areas are properly established.
      b. Lawn is free of bare and dead spots and is without weeds.
      c. No surface soil is visible when grass has been cut to height of 2 inches (50 mm).
      d. Seeded areas have been mowed a minimum of twice.

**END OF SECTION**

**SECTION 32 9223**
**SODDING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sodded lawn as described in Contract Documents.

### 1.02 RELATED REQUIREMENTS

A. Section 32 8423: Irrigation System - No Controllers.

B. Section 32 8466: Irrigation System - Controllers

C. Section 32 9001: Common Planting Requirements:
   1. Pre-installation conference held jointly with other common planting related sections.

D. Section 32 9120: 'Topsoil And Placement'.

E. Section 32 9122: 'Topsoil Grading'.

### 1.03 REFERENCES

A. TPI (SPEC) Certificate: Certify grass species and location of sod source.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 32 9001.

### 1.05 SUBMITTALS

A. Submittals for Information:
   1. Sod Seed Mix:
      a. Written certification confirming sod seed mix and quality:
         1) Include species used.
         2) Include supplier name and contact information.

B. Submittals for Closeout:
   1. Operations And Maintenance Data:
      a. Sod Seed Mix.
   2. Landscape Management Plan (LMP):
      a. Landscape Section:
         1) Sod Seed Mix.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Approval Requirements:
   1. Harvest, deliver, store, and handle sod in accordance with requirements of Turfgrass Producers International (TPI) (formally American Sod Producers Association) Specifications for Turfgrass Sod Materials and Transplanting / Installing.
   2. Schedule deliveries to coincide with topsoil operations and laying. Keep storage at job site to minimum without causing delays.
      a. Deliver, unload, and store sod on pallets within 24 hours of being lifted.
      b. Do not deliver small, irregular, or broken pieces of sod.

B. Storage And Handling Requirements:
   1. Cut sod in pieces approximately 3/4 to one inch (19 to 25 mm) thick. Roll or fold sod so it may be lifted and handled without breaking or tearing and without loss of soil.
   2. During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling.
   3. During dry weather, protect sod from drying before installation. Water as necessary to insure vitality and to prevent excess loss of soil in handling. Sod that dries out before installation will be rejected.

## PART 2 PRODUCTS

## 2.01 MATERIALS

A. Description:
   1. Superior sod grown from certified, high quality, seed of known origin or from plantings of certified grass seedlings or stolons:
      a. Assure satisfactory genetic identity and purity.
      b. Assure over-all high quality and freedom from noxious weeds or an excessive amount of other crop and weedy plants at time of harvest.
   2. Sod shall be composed of three separate varieties. Varieties should include the following attributes:
      a. High traffic tolerance.
      b. Superior color.
      c. Low-water requirement.
      d. Drought tolerance.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Interface With Other Work:
   1. Do not commence work of this Section until work of Sections 32 9122 and 32 9300 has been completed and approved.

B. Tolerances:
   1. Final grade of soil after sodding of lawn areas is complete shall be one inch (25 mm below top of adjacent pavement of any kind.

C. Laying of Sod:
   1. Lay sod during growing season and within 48 hours of being lifted.
   2. Lay sod while top 6 inches (150 mm) of soil is damp, but not muddy. Sodding during freezing temperatures or over frozen soil is not acceptable.
   3. Lay sod in rows perpendicular to slope with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with a sharp knife.
   4. Lay sod flush with adjoining existing sodded surfaces.
   5. Do not sod slopes steeper than 3:1. Consult with Architect for alternate treatment.

D. After Laying of Sod Is Complete:
   1. Roll horizontal surface areas in two directions perpendicular to each other.
   2. Repair and re-roll areas with depressions, lumps, or other irregularities. Heavy rolling to correct irregularities in grade will not be permitted.
   3. Water sodded areas immediately after laying sod to obtain moisture penetration through sod into top 6 inches (150 mm) of topsoil.

## 3.02 FIELD QUALITY CONTROL

A. Field Inspection:
   1. Sodded areas will be accepted at Project closeout if:
      a. Sodded areas are properly established.
      b. Sod is free of bare and dead spots and is without weeds.
      c. No surface soil is visible when grass has been cut to height of 2 inches (50 mm).
   2. Sodded areas have been mowed a minimum of twice.

**END OF SECTION**

**SECTION 32 9300**
**PLANTS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install landscaping plants as described in Contract Documents.

B. Related Requirements:
   1. Section 32 8423: 'Underground Sprinklers: No Controllers' for irrigation system.
   2. Section 32 8466: 'Underground Sprinklers: Controllers' for irrigation system controllers.
   3. Section 32 9001: 'Common Planting Requirements' for:
      a. Pre-installation conference held jointly with other common planting related sections.
   4. Section 32 9120: 'Topsoil And Placement'.
   5. Section 32 9122: 'Topsoil Grading'.
   6. Section 32 9219: 'Seeding'.
   7. Section 32 9223: 'Sodding'.

### 1.02 REFERENCES

A. Definitions:
   1. Landscape Management Plan (LMP): See Section 32 9001 for definition.
   2. Plant Establishment Period: See Section 32 9001 for definition.

B. ANSI/AHIA Z60.1 - American National Standard for Nursery Stock; 2014

C. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices; 2017

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 32 9001.

### 1.04 SUBMITTALS

A. See Section 01 3000-Administrative Requirements, for submittal procedures. Submittals may be included in more than one submittal group listed below.

B. Submittals for Review:
   1. Do not commence work or deliver products to site until Landscape Architect approves submittals for review.
   2. Testing and Evaluation Reports
      a. Percolation Test Report:
         1) Submit written report based on testing described in Part 3.
   3. Samples:
      a. Tree staking systems.
      b. Weed barrier
      c. Organic mulch.
      d. Rock mulch.

C. Submittals for Information:
   1. Establishment Period Acknowledgement. See Section 32 9001:

D. Submittals for Closeout:
   1. Operations and Maintenance Data:
      a. See Section 32 9001.
   2. Record Documentation
      a. See Section 32 9001.
   3. Landscape Warranty. See 'Warranty' below.
   4. Landscape Management Plan (LMP):
      a. Landscape Section. See Section 32 9001.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately.
   2. Do not prune before delivery, except as approved by Landscape Architect.
   3. Protect bark, branches, and root systems from sun scald, drying, whipping, and other handling and tying damage.
   4. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape.
   5. Provide protective covering during delivery.

B. Storage And Handling Requirements;
   1. Handle balled stock by root ball or container. Do not drop trees and shrubs during delivery.
   2. If planting is delayed more than six hours after delivery, set planting materials in shade and protect from weather and mechanical damage.
   3. Set balled stock on ground and cover ball with soil, saw dust, or other acceptable material approved by Landscape Architect.
   4. Do not remove container-grown stock from containers before time of planting.
   5. Do not store plant material on pavement.
   6. Water root systems of trees and shrubs stored on site with fine spray. Water as often as necessary to maintain root systems in moist condition. Do not allow plant foliage to dry out.

**1.06 WARRANTY**

A. Special Warranty:
   1. Provide written warranties as follows:
      a. Warranty will extend thirty (30) continuous days minimum after Substantial Completion. If a continuous first thirty (30) days of the warranty period is interrupted by non-growing season or irrigation winter shut-down, begin warranty period after start of growing season as agreed on with Architect. Thereafter, continue warranty per the period described herein.
      b. Warranty shrubs, ground covers, and vines to live and remain in strong, vigorous, and healthy condition for 90 days minimum from date of Substantial Completion and meet or exceed material standards set forth in Materials heading of Part 2 of this specification.
      c. Warranty trees to live and remain in strong, vigorous, and healthy condition and meet or exceed material standards set forth in Materials heading of Part 2 of this specification for one year from date of Substantial Completion.
      d. When trees are completely accepted at end of warranty period, remove staking.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

A. Plants:
   1. Conform to requirements of Plant List and Key on Contract Documents and to ANSI/AHIA Z60.1.
   2. Nomenclature:
      a. Plant names used in Plant List conform to 'Standardized Plant Names' by American Joint Committee on Horticultural Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear tag showing genus, species, and variety of at least 10 percent of each species delivered to site.
   3. Quality:
      a. Plants shall be sound, healthy, vigorous, free from plant disease, insect pests or their eggs, noxious weeds, and have healthy, normal root systems. Container stock shall be well established and free of excessive root-bound conditions.
      b. Do not prune plants or top trees prior to delivery.
      c. Plant materials shall be subject to approval by Landscape Architect as to size, health, quality, and character.
      d. Bare root trees are not acceptable.

e. Provide plant materials from licensed nursery or grower.

4. Measurements:
   a. Measure height and spread of specimen plant materials with branches in their normal position as indicated on Contract Documents or Plant List.
   b. Measurement should be average of plant, not greatest diameter. For example, plant measuring 15 inches (375 mm) in widest direction and 9 inches (225 mm) in narrowest would be classified as 12 inch (300 mm) stock.
   c. Plants properly trimmed and transplanted should measure same in every direction.
   d. Measure caliper of trees 6 inches (150 mm) above surface of ground.
   e. Where caliper or other dimensions of plant materials are omitted from Plant List, plant materials shall be normal stock for type listed.
   f. Plant materials larger than those specified may be supplied, with prior written approval of Landscape Architect, and:
      1) If complying with Contract Document requirements in all other respects.
      2) If at no additional cost to Owner.
      3) If sizes of roots or balls are increased proportionately.
5. Shape and Form:
   a. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List.
   b. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3's of height.

## 2.02 ACCESSORIES

A. Planting Mix:
   1. Mixture of three (3) parts excavated soil and one part well rotted composted manure, approved commercial mix, or other amendment recommended in 'Topsoil Testing Report'.

B. Fertilizer:
   1. Fertilizer as recommended in ‘Topsoil Testing Report’.

C. Tree Stakes:
   1. 2 inch (50 mm) diameter Lodgepole Pine, Douglas Fir, White Fir, or Hemlock Fir.

D. Tree Staking Ties:
   1. 32 inch (800 mm) Cinch-Tie tree ties by V.I.T. Products Inc, Escondido, CA www.vitproducts.com.

E. Tree Guys:
   1. Duckbill Model 68DTS guying kit.

F. Pre-Emergent Herbicide:
   1. Chipco Dimension Granular by The Andersons Inc, Maumee, IL www.andersonsinc.com.
   2. Elanco XL2G granular by Crop Data Management Systems, Marysville, CA www.cdms.net.
   3. Ronstar G granular by Bayer Crop Science, Monheim, Germany www.bayercropscience.com.
   4. Surflan AS liquid by United Phosphorous Inc, Trenton, NJ www.upi-usa.com.
   5. Oryzalin 4 A.S. liquid by FarmSaver, Seattle, WA www.farmsaver.com.

G. Weed Barrier:
   1. DeWitt 4.1 oz (116 g) 20 year woven polypropylene weed barrier.
   2. Hanes Pro-Platinum 4.1 oz (116 g) 20 year woven polypropylene weed barrier.

H. Organic Mulch:
   1. Medium size Fir bark.
   2. Medium or large size Redwood bark.
   3. Shredded pine bark.
   4. Shredded Cedar.

I. Rock Mulch:
   1. Rock mulch.

a. Size:
1) No rock should be less than 3/4 inch (19 mm) in size.
2) For slopes 3:1 or less 3/4 inch (19 mm) to 1-1/2 inches (38 mm).
3) For steep slopes greater than 3:1: Size can be larger than 1-1/2 inches (38 mm).

J. Substitutions: See Section 01 6000 - Product Requirements.
1. Equals as approved by Landscape Architect prior to bid.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Evaluation And Assessment:
1. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and site to Landscape Architect before proceeding with work of this Section.
2. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Contract Documents. All planting indicated on Contract Documents is required unless indicated otherwise.
3. Do not commence with this Work until all work including grading tolerances specified in Section 32 9122 ‘Topsoil Grading’ are completed and approved.

### 3.02 PREPARATION

A. Plant Approval:
1. Compliance:
a. Prior to any plant installation, evaluate plants for compliance with material standards.
b. Remove plants from site that do not comply.
2. Inspection:
a. Prior to any tree installation, inspect one (1) extra deciduous tree and one (1) extra evergreen tree for root health.
b. In presence of Landscape Architect or by video recording, remove root container/packing material and inspect root balls for soil depth, firmness and root structure by washing soil off of roots.
c. If delivered plants exhibit soil 1 inch (25 mm) or more above root collar, demonstrate that all trees have had excess soil removed prior to planting or that they meet standard.
d. Remove and replace tree plant material if roots are loose, significantly circling, significantly asymmetrical or damaged.
e. Continue inspection process until trees meet standard.

B. Layout individual tree and shrub locations and areas for multiple plantings:
1. Stake locations and outline areas.
2. Secure Landscape Architect's approval before planting.
3. Make minor adjustments as may be requested.

### 3.03 INSTALLATION

A. Excavation:
1. If underground construction work or obstructions are encountered in excavation of planting holes, Landscape Architect will select alternate locations.
2. Plant Excavation Size:
a. Diameter: Twice diameter of root ball or container minimum.
b. Depth: Equal to container or root ball depth.
3. Unless excavated material meets topsoil requirements as specified in Section 32 9120, remove from landscape areas and do not use for landscaping purposes.
4. Roughen sides and bottoms of excavations.
5. Perform percolation test and create report.
a. With approval of Landscape Architect, select five (5) typical planting excavations throughout site for drainage testing.
1) Fill selected excavations with water and verify that water drains away at rate of 3 inches (75 mm) per hour minimum.

2) If it doesn't, select three (3) excavations approximately 5 feet (1 500 mm) away from each non-draining excavation and repeat tests. Continue testing process until non-draining areas have been identified.
3) Within excavations located in identified non-draining areas, auger 6 inch (150 mm) diameter hole 4 feet (1 200 mm) deep in low point of each excavation and fill with tamped planting mix.

b. Create report identifying area where water did not drain properly and describe corrective measures taken.
c. Do not plant trees or shrubs in holes that do not properly drain.

B. Planting:
1. Removing Binders And Containers:
a. Remove top one / third of wire basket and burlap binders.
b. Remove plastic and twine binders from around root ball and tree trunk.
c. Remove plastic containers.
d. Remove wood boxes from around root ball. Remove box bottoms before positioning plant in hole. After plant is partially planted, remove remainder of box without injuring root ball.
2. Plant immediately after removing binding material and containers:
a. Place tree and shrub root balls on undisturbed soil.
b. After watering and settling, top of tree root balls shall be approximately two inches (50 mm) higher than finished grade and trunk flare is visible.
c. Shrub root balls shall be approximately one inch (25 mm) higher than finished grade.
3. Properly cut off broken or frayed roots.
4. Center plant in hole, remove remaining wire basket and burlap taking care not to damage root ball:
a. Replace damaged material.
b. Backfill with specified planting mix.
c. Except in heavy clay soils, make ring of mounded soil around hole perimeter to form watering basin.
5. Add fertilizer in plant pit as per ‘Topsoil Testing Report’ and during proper season.
6. Fill landscape excavations with tamped planting mix and recommended fertilizer:
a. Compact in 6 inch (150 mm) lifts.
b. Settle by watering to ensure top of root ball is 2 inches (50 mm) higher for trees and one inch (25 mm) higher for shrubs than surrounding soil following compaction and settling.
7. Do not use muddy soil for backfilling.
8. Make adjustments in positions of plants as directed by Landscape Architect.
9. Thoroughly water trees and shrubs immediately after planting.
10. At base of each tree, leave 36 inch (900 mm) diameter circle free of any grass.

C. Tree and Shrub Pruning:
1. Prune trees and shrubs to remove dead, broken, and split branches in conformance with ANSI A300 (Part 1) Pruning.

D. Supports for New Trees:
1. Provide new supports for trees noted on Contract Documents to be staked.
a. Remove nursery stakes delivered with and attached to trees.
b. Support shall consist of at least two (2) tree stakes driven into hole base before backfill so roots are not damaged. Place stakes vertically and run parallel to tree trunk. Install stakes so 3 feet (900 mm) of stake length is below finish grade.
c. Deciduous Trees:
1) Place tree ties 6 to 12 inches (150 to 300 mm) below crotch of main tree canopy. Second set of tree ties may be required 18 to 24 inches (450 to 600 mm) above finish grade, if directed by Landscape Architect.
2) Remove tops of tree stakes so top of stake is 6 inches (150 mm) below main tree canopy to prevent damage to tree branches and canopy growth.
d. Evergreen Trees:

1) Place tree ties 2/3's of height of tree up from root ball.

2. Provide root guying kits to support 24 inch (600 mm) box, 3 inch (75 mm) caliper and larger trees.
3. Staking and guying should allow some tree movement.

E. Vines:
1. Remove from stakes, untie, and securely fasten to wall or fence next to which they are planted.

F. Ground Covers:
1. Container-grown unless otherwise specified on Contract Documents. Space evenly to produce a uniform effect, staggered in rows and intervals shown.

G. Post Planting Weed Control:
1. Apply specified pre-emergent herbicide to shrub and ground cover planting areas and grass-free areas at tree bases after completion of planting.
2. Areas shall be weed free prior to Landscape Final Acceptance.

H. Weed Barrier Fabric:
1. After planting and application or herbicide in shrub beds, apply covering of specified weed barrier fabric.
2. Achieve 100 percent coverage over ground areas away from root ball.
3. Overlap seams 6 inches (150 mm) minimum.
4. Staple at 5 feet (1500 mm) on center each way and within 3 inches (75 mm) of edge of shrub bed, with two (2) at each corner.

I. Mulching:
1. After application of herbicide, mulch shrub and ground cover planting areas with 3 inches (75 mm) deep layer of specified organic or rock mulch.
2. Cover grass-free area at tree bases with 3 inches (75 mm) of organic mulch where applicable.
3. Place mulch to uniform depth and rake to neat finished appearance.

**END OF SECTION**

## SECTION 33 0110
## DISINFECTION OF WATER UTILITY PIPING SYSTEMS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Disinfection of site domestic water lines and site fire water lines specified in Section 33 1416.

B. Disinfection of building domestic water piping specified in Section 22 1005.

### 1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping: Disinfection of building domestic water piping system.

B. Section 33 1416 - Site Water Utility Distribution Piping.

### 1.03 REFERENCE STANDARDS

A. AWWA B300 - Hypochlorites 2018.

B. AWWA B301 - Liquid Chlorine 2018.

C. AWWA B302 - Ammonium Sulfate 2016.

D. AWWA B303 - Sodium Chlorite 2018.

E. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).

### 1.04 QUALITY ASSURANCE

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three years documented experience.

B. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of the State in which the Project is located.

C. Submit bacteriologist's signature and authority associated with testing.

### PART 2 PRODUCTS

### 2.01 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate, and AWWA B303 Sodium Chlorite.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that piping system and water well has been cleaned, inspected , and pressure tested.

B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

### 3.02 DISINFECTION

A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.

B. Flush with municipal domestic water until clear of all residue and clean flowing

C. Inject treatment disinfectant into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

### 3.03 FIELD QUALITY CONTROL

A. Test samples in accordance with AWWA C651.

**END OF SECTION**

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**SECTION 33 1113**
**FACILITY WATER DISTRIBUTION PIPING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

### 1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Pipe Materials, Valves, Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Operation and maintenance data.

### 1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

### 1.04 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

### 1.05 COORDINATION

A. Coordinate connection to water main with utility company.

## PART 2 PRODUCTS

### 2.01 PIPE AND FITTINGS

A. Ductile-Iron Pipe: AWWA C151, Class 52, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts for Mechanical Joints: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
3. Gaskets for Push-on Joints: AWWA C111, rubber.

### 2.02 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Non-rising-Stem, Resilient-Seated Gate Valves:
   a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

### 2.03 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Description: Sleeve and valve compatible with drilling machine.
    a. Standard: MSS SP-60.
    b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
    c. Valve: AWWA, cast-iron, non-rising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
    1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

**2.04 WATER METERS**

A. Water meters will be furnished by utility company.

**2.05 CONCRETE METER VAULT**

A. Description: Precast, reinforced-concrete vault, per APWA Plan 505.

**2.06 FIRE HYDRANTS**

A. Dry-Barrel Fire Hydrants:
    1. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
        a. Standard: AWWA C502.
        b. Pressure Rating: 150 psig minimum.

**PART 3 EXECUTION**

**3.01 EARTHWORK**

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

**3.02 PIPING APPLICATIONS**

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

**3.03 VALVE APPLICATIONS**

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, non-rising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
    1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, non-rising-stem, resilient-seated gate valves with valve box.
    2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, non-rising-stem gate valves with indicator post.

**3.04 PIPING INSTALLATION**

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:
    1. Install tapping sleeve and tapping valve according to MSS SP-60.
    2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
    3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
    4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.
E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
F. Bury piping with depth of cover over top at least 60 inches, with top at least 12 inches below level of maximum frost penetration.
G. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
H. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

**3.05 ANCHORAGE INSTALLATION**

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints.
   5. Pipe clamps and tie rods.
B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches.
C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

**3.06 VALVE INSTALLATION**

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
B. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

**3.07 WATER METER INSTALLATION**

A. Install water meters, piping, and specialties according to utility company's written instructions.

**3.08 WATER METER BOX INSTALLATION**

A. Install water meter boxes flush with surface.

**3.09 FIRE HYDRANT INSTALLATION**

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
B. AWWA Fire Hydrants: Comply with AWWA M17.

**3.010 CONNECTIONS**

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect water-distribution piping to existing water main using tapping sleeve and tapping valve.
C. Connect water-distribution piping to interior domestic water and fire-suppression piping.

**3.011 FIELD QUALITY CONTROL**

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water. Complete tests in accordance with Provo City requirements.
B. Prepare reports of testing activities.

**3.012 IDENTIFICATION**

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."
B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 Section "Common Work Results for Plumbing" for identifying devices.

**3.013 CLEANING**

A. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for

flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
   a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
   b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
   c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

**END OF SECTION**

**SECTION 33 1313**
**FACILITY SANITARY SEWERS**

## PART 1 GENERAL

### 1.01 SUMMARY

A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:
   1. Cleanouts.
   2. Precast concrete manholes.

### 1.02 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

### 1.03 SUBMITTALS

A. Shop Drawings: Pipe materials, manholes (include plan, sections, details and covers).
B. Coordination Drawings: Show pipe sizes, locations, and elevations.
C. Field quality-control test reports.

## PART 2 PRODUCTS

### 2.01 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

### 2.02 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

### 2.03 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
B. Sleeve Materials:
   1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
C. Unshielded, Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

### 2.04 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   1. Top-Loading Classification: Light and Heavy duty.
   2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

### 2.05 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   1. Diameter: 48 inches minimum, unless otherwise indicated.
   2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
   3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
   5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
   7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
   8. Steps: Individual FRP steps, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-

inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
    a. Material: ASTM A 48/A 48M, Class 35 gray iron, unless otherwise indicated.

**2.06 CONCRETE**

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
   1. Cement: ASTM C 150, Type II.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
   1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
      a. Invert Slope: 2 percent through manhole.
   2. Benches: Concrete, sloped to drain into channel.
      a. Slope: 8 percent.

**PART 3 EXECUTION**

**3.01 PIPING APPLICATIONS**

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
   1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
      a. Unshielded flexible couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range:
   1. NPS 3 and NPS 4: NPS 4 PVC sewer pipe and fittings, gaskets, and gasketed joints.
   2. NPS 5 and NPS 6: NPS 6 PVC sewer pipe and fittings, gaskets, and gasketed joints.
   3. NPS 8 and NPS 10: PVC sewer pipe and fittings, gaskets, and gasketed joints.
   4. NPS 12 and NPS 15: PVC sewer pipe and fittings, gaskets, and gasketed joints.

**3.02 PIPING INSTALLATION**

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at slope indicated.
2. Install piping with 48-inch minimum cover.
3. Install piping below frost line.
4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

**3.03 PIPE JOINT CONSTRUCTION**

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
2. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

**3.04 MANHOLE INSTALLATION**

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

**3.05 CLEANOUT INSTALLATION**

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

**3.06 CONNECTIONS**

A. Make connections to existing piping and underground manholes in accordance with utility company standards.

**3.07 FIELD QUALITY CONTROL**

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
   a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
   b. Close openings in system and fill with water.
   c. Purge air and refill with water.
   d. Disconnect water supply.

e. Test and inspect joints for leaks.
f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
b. Option: Test concrete gravity sewer piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

**END OF SECTION**

## SECTION 33 1416
## SITE WATER UTILITY DISTRIBUTION PIPING

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Water pipe for site conveyance lines.

B. Pipe valves.

C. Water meter:
   1. Furnish and install piping for domestic water supply from water main to within 5 feet (1.50 meter) of building as described in Contract Documents complete with meter, shut-off valve, and connections.
   2. Furnish and install piping from water main to meter inside of building as described in Contract Documents complete with shut-off valve and connections.

D. Fire Suppression water system
   1. Water piping
   2. In-building riser
   3. Post-Indicator Valve
   4. Fire hydrants.

### 1.02 RELATED REQUIREMENTS

A. Section 03 3000 Cast in place Concrete 'Structural Cast-In-Place Concrete Forming' for installation of sleeve where piping penetrates slab.
   1. Mix Type concrete mixes and admixtures.
   2. Pre-installation conference held jointly with other concrete specifications.

B. Section [church] 08 7100:  'Securing Devices' for padlock for indicator post valve.

C. Section 21 1300 -  'Wet-Pipe Sprinkler Systems'.

D. Section 21 1316 - 'Dry-Pipe Sprinkler Systems'.

E. Section 09 9113 - Exterior Painting.

F. Section 21 1313 - Wet-Pipe Sprinkler Systems

G. Section 31 2316 - Excavation and Trenching for excavation and trenches

H. Section 31 2323 - Fill

I. Section 31 2316.13 - Trenching:  Excavating, bedding, and backfilling.

### 1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

D. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.

E. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2021.

F. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 2020.

G. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter 2022.

H. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

I. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.

J. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service 2019.

K. AWWA C502 - Dry-Barrel Fire Hydrants 2018.

L. AWWA C606 - Grooved and Shouldered Joints 2015.

M. AWWA C800 - Underground Service Line Valves and Fittings 2021.

N. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm) 2016, with Errata (2018).

O. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 3/4 In. (19 mm) Through 3 In. (76 mm), for Water Service 2020.

P. AWWA C904 - Cross-Linked Polyethylene (PEX) Pressure Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service 2016.

Q. UL 246 - Hydrants for Fire-Protection Service Current Edition, Including All Revisions.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Certificates: Fire Suppression
   1. Provide one (1) copy of completed NFPA 13 'Contractor's Material and Test Certification for Underground Piping' as specified in 'Field Quality Control' in Part 3 of this specification:

E. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

### 1.06 QUALITY ASSURANCE

A. Perform Work in accordance with utility company requirements.

B. Regulatory Agency Sustainability Approvals:
   1. Install exterior fire water system according to NFPA 13, NFPA 24, and AWWA Manual M41, ‘Ductile-Iron Pipe and Fittings’ procedures unless specified otherwise below.
   2. Install hydrant in accordance with AWWA C502.
   3. Install exterior fire water system up to and including pipe flange 12 inches (300 mm) above floor inside building.
   4. Bury fire service mains at least 6 inch (150 mm) deeper than municipal water works piping. Additional depth of cover is necessary because of lack of water circulation in fire service mains.

## PART 2 PRODUCTS

### 2.01 WATER PIPE FOR DOMESTIC AND FIRE SUPPRESSION

A. Copper Tubing: ASTM B88, Type K, Annealed
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.

B. Thermoplastic Plastic Piping:
   1. Fittings: Same Manufacture as pipe
      a. “MEGALUG” Mechanical Joint Restraint for Duct Iron Pipe is not approved for use.
   2. Joints: Methods approved by manufacture
   3. Manufacturers:
      a. Approved Products
         1) Pipe: HDPE DR9 meeting ASTM and NSF requirements.
         2) Pipe: PP-R SDR 7.4 Greenpipe faser by Aquatherm.

3) PP-RCT SDR 7.4 Red Stripe fiber core by Prestan.

C. Polyethylene Pipe: AWWA C901:
   1. Fittings: AWWA C901, molded or fabricated.
   2. Joints: Compression.

D. HDPE Polyethylene Flexible
   1. Joints: Fusion

E. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

F. Water Meter: As required by local agency furnishing water.

G. Tamper Switch:
   1. UL/ULC listed and FM approved.
   2. Weather and tamper resistant.
   3. Single Pole Double Throw Switch.
   4. Approved Products:
      a. Potter Electric Signal: Model PCVS.

H. Anchorages:
   1. Provide anchorages for tees, plugs, caps, bends, and hydrants in accordance with NFPA 24.
   2. Miscellaneous Fittings:
      a. Clamps, Straps, And Washers: Steel, meeting requirements of ASTM A506.
      b. Rods: Steel, meeting requirements of ASTM A575.
      c. Rod Couplings: Malleable iron, meeting requirements of ASTM A197/A197M.
      d. Bolts: Steel, meeting requirements of ASTM A307.
      e. Cast Iron Washers: Meeting requirements of ASTM A126, Class A.
      f. Thrust Block: 2500 psi (17.92 MPa) concrete.

I. In-Building Riser:
   1. Meet NSF International Standards for Lead Free, NSF 61-G certified, 200 psi (1.38 MPa) maximum pressure and one piece.
   2. UL/ULC listed and FM approved.
   3. AWWA C900 Inlet/DIP and AWWA C606 Outlet.
   4. Corrosion resistant stainless steel construction, type 304.
   5. Includes test cap and coupler.
   6. Approved Products. See Section 01 6200 for def:
      a. In-Building Riser (Series IBC) by Ames:
      b. Size to match project requirements.

**2.02 VALVES**

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches:
   1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.
   2. Compatible with piping system and approved by pipe manufacture

C. Gate Valves 3 Inches and Over:
   1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, post indicator, valve key, and extension box.
   2. Cast iron body with bolted bonnet.
   3. Indicator post pattern.
   4. Non-rising stem.
   5. 175 psi (1.21 MPa) working pressure.
   6. Approved Products.
      a. Nibco:

1) Model M-609 with mechanical connection.
2) Model F-609 with flanged connection.

b. Mueller:

1) Model A-2052-5 with mechanical connection.
2) Model A-2052-6 with flanged connection.

D. Indicator Post Valve:

1. UL/ULC listed and FM approved.
2. Adjustable type.
3. Cast iron body.
4. Approved Products:
   a. Nibco: Model NIP1A Vertical Post.
   b. Mueller: Model A-20806 Adjustable vertical indicator post.

E. Stop And Waste Valves:

1. Use with lawn sprinkler system using domestic water. If AHJ does not allow stop and waste valves, specify acceptable shut-off valve for lawn sprinkler system.
2. Approved Products
   a. Mueller: Mark II Oriseal stop and waste valve H10288.
   b. Mueller: Buffalo screw type curb box H-10350 complete with lid and H-10349 enlarged base.

F. Provide cast iron valve box for fire protection valve. Encase valve box in concrete.

G. Manufacturers:

1. Ames Fire & Waterworks; [____]: www.amesfirewater.com/#sle.
2. Ipex Inc, Englewood, CO www.ipexinc.com.
3. Mueller Company; [____]: www.muellerflo.com/#sle.
4. Nibco Inc; [____]: www.nibco.com/#sle.
5. Potter Electric Signal Company, St Louis, MO www.pottersignal.com.
6. Potter-Roemer, Santa Ana, CA www.potterroemer.com.

## 2.03 FIRE HYDRANTS

A. Hydrants: AWWA C502, UL 246, dry barrel type.

1. Dry-barrel fire hydrant (base valve type) complying with AWWA C150-A21.50, with 150 psi (1.03 MPa) working pressure with two 2-1/2 inch (64 mm) hose connections and one 4-1/2 inch (115 mm) pumper connection with caps and chains.
2. Nozzle cap nuts to match operating stem nuts.
3. Minimum 6 inch (150 mm) supply pipe.
4. Hose and Streamer Connection: Match sizes with utility company, two hose nozzles , one pumper nozzle.
5. Pressure Rating: Minimum 150 PSI working pressure. Higher if required by utility company.
6. Finish: Primer and two coats of enamel in color-code or as required by AHJ/utility company.
   a. Caps and Nozzle caps should be painted IAW NFPA 24:
      1) Less ten 500 gpm: Red
      2) 500 to 999 gpm: Orange
      3) 1000 to 1499 gpm: Green
      4) 1500 gpm and above Light Blue

## 2.04 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2316.13.

B. Cover: As specified in Section 31 2316.13.

## 2.05 ACCESSORIES

A. Backflow Preventer: Usually provided inside the building.

B. Meter: As required by local agency furnishing water.

C. Pipe Sleeve at slab penetration:
   1. Quality Standard. See Section 01 6200:
   2. Any material rigid enough to resist deformation when concrete poured.
   3. Size: Provide 2 inch (50 mm) minimum space between piping assembly and sleeve.

D. Casing Spacer: Stainless steel spacer designed to maintain pipe casing integrity.
   1. Manufacturers:
      a. Advance Products & Systems, LLC; [_____]: www.apsonline.com/#sle.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

B. Verify location of water meter, underground or in building.

**3.02 PREPARATION**

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

**3.03 TRENCHING**

A. See the sections on excavation and fill for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

D. Excavate and backfill as specified in Sections 31 2316 and 31 2323 with following additional requirements:
   1. Runs shall be as close as possible to those shown on Contract Drawings.
   2. Excavate to required depth.
   3. Bottom of trenches shall be hard. Tamp as required.
   4. Remove debris from trench before laying pipe.
   5. Do not cut trenches near footings without consulting Architect.
   6. Excavate trenches so outside pipe will be at least 12 inches (300 mm) minimum below frost line or 48 inches (1200 mm) minimum below finish grade, whichever is deeper.
   7. Backfill only after pipe lines have been tested and inspected, and approved by Architect.
   8. Install piping system so it may contract and expand freely. Eliminate completely cross connections, backflow, and water hammer.

**3.04 INSTALLATION - PIPE**

A. Perform trenching and backfilling required for work of this Section

B. Maintain separation of water main from sewer piping in accordance with [_____] code.

C. Group piping with other site piping work whenever practical.

D. Establish elevations of buried piping to ensure not less than [_____] feet of cover.
   1. Install top of pipe at least 12 inches below frost line.

E. Install crosslinked polyethylene tubing and fittings to AWWA C904.

F. Place 18 gage yellow tracer wire along side when installing pipe:
   1. Tracer wire shall run from water main isolation valve to and past all connections, to PIV and each fire hydrant and fire riser.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Slope water pipe and position drains at low points.

J. Install shut-off valve at meter.

K. Fire Suppression
   1. Regulatory Agency Sustainability Approvals:
      a. Install exterior fire water system according to NFPA 13, NFPA 24, and AWWA Manual M41, 'Ductile-Iron Pipe and Fittings' procedures unless specified otherwise below.
      b. Install hydrant in accordance with AWWA C502.
      c. Install exterior fire water system up to and including pipe flange 12 inches (300 mm) above floor inside building.
      d. Bury fire service mains at least 6 inch (150 mm) deeper than municipal water works piping. Additional depth of cover is necessary because of lack of water circulation in fire service mains.

**3.05 INSTALLATION - VALVES AND HYDRANTS**

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway in accordance with Section 21 1100.

D. Set hydrants to grade, with nozzles at least 20 inches above ground in accordance with Section 21 1100.

E. Locate control valve 4 inches away from hydrant.

F. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

G. Paint hydrants in accordance with Section 09 9113.
   1. Fire Hydrant Color-Code:
      a. Caps and Nozzle caps should be painted IAW NFPA 24:
         1) Less ten 500 gpm: Red
         2) 500 to 999 gpm: Orange
         3) 1000 to 1499 gpm: Green
         4) 1500 gpm and above Light Blue

H. Provide anchorages for tees, plugs, caps, bends, and hydrants in accordance with NFPA 24.

I. Miscellaneous Fittings:
   1. Clamps, Straps, And Washers: Steel, meeting requirements of ASTM A506.
   2. Rods: Steel, meeting requirements of ASTM A575.
   3. Rod Couplings: Malleable iron, meeting requirements of ASTM A197/A197M.
   4. Bolts: Steel, meeting requirements of ASTM A307.
   5. Cast Iron Washers: Meeting requirements of ASTM A126, Class A.
   6. Thrust Block: 2500 psi (17.92 MPa) concrete.

**3.06 SERVICE CONNECTIONS**

A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves and sand strainer.

B. Anchor service main to interior surface of foundation wall.

**3.07 FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Treat and test water supply until bacteriological testing results are negative.

C. Pressure test water piping to 100 pounds per square inch.

1. Pressure Test: Before covering pipes, test system in presence of Architect or governing agency at 100 psi (0.69 MPa) hydrostatic pressure for two (2) hours and show no leaks

D. Field Tests
   1. Sterilization And Negative Bacteriological Test:
      a. Sterilize potable water system with solution containing 200 parts per million minimum of available chlorine and maintaining a pH of 7.5 minimum. Introduce chlorinating materials into system in manner approved by Architect. Allow sterilization solution to remain for twenty-four (24) hours and open and close valves and faucets several times during that time.
      b. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.
      c. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

E. Field Tests: Fire Suppression Piping System
   1. Test system according to NFPA 13 (2010, 2013, and 2016), figure 10.10.1, 'Contractor's Material and Test Certification for Underground Piping':
   2. Provide signed copy of certificate with field test information with Closeout Submittals:
      a. Certificate to include following information in ‘Additional explanation and notes’ area of certificate with following:
      b. In-Building Riser: Manufacturer brand, size, material and size of trust blocking.

## 3.08 CLOSEOUT

A. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   1. Record Documentation:
   2. Signed NFPA 13 'Contractor's Material and Test Certification for Underground Piping' with ‘In-Building Riser’ information included.

**END OF SECTION**

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**SECTION 33 4100**
**STORM UTILITY DRAINAGE PIPING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
   1. Cleanouts.
   2. Precast Concrete Manholes

### 1.02 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

### 1.03 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: For manholes, catch basins and inlet boxes (include sections, details, frames and covers, and catch basin frames and grates).
C. Coordination Drawings: Show pipe sizes, locations, and elevations.
D. Field quality-control test reports. Product Data: For each type of product indicated.

## PART 2 PRODUCTS

### 2.01 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

### 2.02 HDPE PIPE AND FITTINGS

A. Corrugated HDPE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
   1. Watertight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
B. Corrugated HDPE Drainage Pipe and Fittings NPS 12 and Larger: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
   1. Watertight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

### 2.03 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

### 2.04 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
B. Sleeve Materials:
   1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

### 2.05 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   1. Top-Loading Classification(s): Light and Heavy duty.
   2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

## 2.06 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
   1. Cement: ASTM C 150, Type II.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

## 2.07 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   2. Joint Sealant: ASTM C 990 , bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch- diameter flat grate with small square or short-slotted drainage openings.
   1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

# PART 3 EXECUTION

## 3.01 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
   1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
      a. Unshielded flexible couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range:
   1. NPS 3 to NPS 6: Corrugated PE drainage pipe and fittings, watertight couplings, and coupled joints.
   2. NPS 8 to NPS 15: Corrugated PE drainage pipe and fittings, watertight couplings, and coupled joints.
   3. NPS 18 to NPS 30: Corrugated PE pipe and fittings, watertight couplings, and coupled joints.

## 3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure drainage piping according to the following:
   1. Install piping pitched down in direction of flow, at slope indicated.
   2. Install piping with 24-inch minimum cover.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

**3.03 CLEANOUT INSTALLATION**

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

**3.04 CATCH BASIN INSTALLATION**

A. Set frames and grates to elevations indicated.

**3.05 CONNECTIONS**

A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

**3.06 FIELD QUALITY CONTROL**

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

**END OF SECTION**

**SECTION 33 5216**
**GAS HYDROCARBON PIPING**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Includes But Not Limited To:

B. Perform excavation and backfill required for work of this Section.
   1. Furnish and install gas piping and fittings as described in Contract Documents from gas main to meter.
   2. Provide, make necessary arrangements for, and pay necessary fees to local gas utility company for gas service lines and proper size gas meter.

### 1.02 SECTION INCLUDES

A. Pipe and fittings for natural gas distribution on site outside buildings.

### 1.03 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Foundations for concrete meter base.

B. Section 05 0523 - Metal Fastening for welding standards and requirements.

C. Section 22 1005 - Plumbing Piping.

D. Section 23 1123 - Facility Natural-Gas Piping.

E. Section 26 0583 - Wiring Connections.

F. Section 31 2316 - Excavation and Trenching for excavating, bedding, and backfilling

G. Section 31 2323 - Fill and Aggregate Base: Bedding and backfilling.

### 1.04 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

B. ASME BPVC - Boiler and Pressure Vessel Code 2021.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

D. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

### 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations of pipe mains, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

### 1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Lay underground pipe in accordance with federal pipeline safety regulations and local gas utility company regulations and specifications.

B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
   1. Polyethylene Pipe Installers:
      a. Properly trained and certified in procedure for joining polyethylene pipe.
   2. Welders:
      a. Certified and bear evidence of certification 30 days before commencing work on project.
      b. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test.
      c. This shall be done at no cost to Owner.
      d. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.

1) Welders Certification: In accordance with ASME BPVC-IX.

C. Welding Materials and Procedures: Comply with ASME BPVC and applicable state regulations.

## PART 2 PRODUCTS

### 2.01 PIPE

A. Manufacturers:
   1. [_____]; Product [____].
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Pipe And Fittings Above Ground (Steel): ASTM A53/A53M, Schedule 40 black:
   1. Fittings (butt-welded if not fitted): ASME B16.3 malleable iron, ASME B16.11 forged steel, or ASTM A234/A234M wrought steel welding type.
   2. Joints: Threaded.

C. Pipe And Fittings Below Ground (Polyethylene):
   1. Polyethylene pipe and fittings meeting requirements of ASTM D2513 and SDR11.
   2. Yellow color
   3. Joints: Mechanical or compression fit or fusion.
   4. Do not store polyethylene pipe so it is exposed to sunlight.

D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Natural Gas Service " in large letters.

### 2.02 GAS COCKS AND VALVES

A. Gas Cocks Up to 2 Inches: 150 psig water or gas (WOG), bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends with cast iron curb box, cover, and key.

B. Gas Cocks Over 2 Inches: 125 psig WOG, Cast iron body and tapered plug, non-lubricated, Teflon packing, threaded ends, with cast iron curb box, cover, and key.

## PART 3 EXECUTION

### 3.01 TRENCHING

A. See Section 31 2316 and 31 2323 for excavation, bedding, and backfilling.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

### 3.02 INSTALLATION - PIPING

A. Excavate and backfill as specified in Section 31 2316 and 31 2323 with following additional requirements:
   1. Runs shall be as close as possible to those shown on Contract Drawings.
   2. Excavate to required depth.
   3. Bottom of trenches shall be hard. Tamp as required.
   4. Remove debris from trench before laying pipe.
   5. Do not cut trenches near footings without consulting Architect.
   6. Place 4 inches of sand around pipe before trench is backfilled.
   7. Bury outside pipe 12 inches minimum below frost line or 18 inches minimum below finish grade, whichever is deeper.
      a. Establish elevations of buried piping to ensure not less than 24 inches of cover in non-travelled areas and 48 inches of cover in driveways and parking areas.
   8. Backfill only after pipe lines have been tested, inspected, and approved by Architect.

B. General installation shall be as specified in Division 23:
   1. Steel pipe 2-1/2 inches and larger shall have welded fittings and joints.
   2. Provide 24 inch minimum steel pipe between vertical rise of riser and end of polyethylene line if anode-less riser is not used. Use plastic-to-steel transition or compression fitting between end of service line and steel meter riser. Provide cathodic protection for steel riser or use anode-less riser.

3. Place tracer wire along side of polyethylene pipe from meter to main and to the building .

C. Group piping with other site piping work whenever practical.

D. Route piping in straight line.

E. Install piping to conserve space and not interfere with use of site space.

F. Install piping to allow for expansion and contraction without stressing pipe or joints.

G. Install cocks and other fittings.

H. Install trace wire 6 inches above top of pipe; coordinate with Section 31 2316.13.

I. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.

**3.03 FIELD QUALITY CONTROL**

A. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

**END OF SECTION**

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