

Received
Planning Division
05/26/2023

ELMONICA STATION APARTMENTS

Project Number: # 215390

PROJECT MANUAL

GMP SET



Submittal Date:
APRIL 24, 2023



Ankrom Moisan

38 NW Davis Street #300 / Portland, OR 97209
503.245.7100 / www.ankrommoisan.com

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ATTACHMENTS

- EXHIBIT A: DOOR HARDWARE CUTSHEETS - ASSA

**SECTION 00 01 03
PROJECT DIRECTORY**

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR 97006.

1.02 OWNER

- A. Owner's Name: Rembold Properties, LLC.
 - 1. Address: 10305 SW Park Way, Suite 204.
 - 2. City: Portland, Oregon 97225.
 - 3. Tel: (503) 222-7258.
 - 4. Project Manager: Chad Fackler.
 - 5. E-mail: chad@rembold.com.

1.03 ARCHITECT

- A. Architect's Name: Ankrom Moisan Architects, Inc.
 - 1. Portland Office:
 - a. 38 NW Davis Street, Suite 300, Portland, Oregon 97209.
 - b. Tel: 503-245-7100.
 - 2. Principal In Charge: Isaac Johnson.
 - 3. Project Manager: Francis Dardis.
 - 4. Tel: 503.892.7304.
 - 5. E-mail: francisd@ankrommoisan.com.

1.04 GENERAL CONTRACTOR

- A. Name: LCG Pence Construction, LLC.
 - 1. Address: 2720 SW Corbett Avenue.
 - 2. City: Portland, OR 97201.
 - 3. Tel: 503.252.3802.
 - 4. Project Manager: Dan Cowley.
 - 5. E-mail: danc@lcfgp.com.

1.05 CIVIL ENGINEER

- A. Name: BKF Engineers.
 - 1. Address: 2175 NW Raleigh Street, Suite 11, Office 2094.
 - 2. City: Portland, OR 97210.
 - 3. Tel: 503.553.5731.
 - 4. Project Manager: Jason White.
 - 5. E-mail: jwhite@bkf.com.

- B. Name: Janet Turner Engineering.
 - 1. Address: 16869 65th AVE #194.
 - 2. City: lake Oswego, OR 97035.
 - 3. Tel: 541.510.0878.
 - 4. Project Manager: Janet Turner.
 - 5. E-mail: jturner@jturnerengineering.com.

1.06 STRUCTURAL ENGINEER

- A. Name: Stonewood Structural Engineers, Inc.
 - 1. Address: 4600 NW Camas Meadows Drive, Suite 2052001 NW 19th, Suite 103A.
 - 2. City: Portland, OR 97209.
 - 3. Tel: 360.216.1704.
 - 4. Project Manager: Scott Nyseth.
 - 5. E-mail: scott.nyseth@stonewoodstructural.com.

1.07 PLUMBING ENGINEER - DESIGN ASSIST

- A. Name: MKE & Associates.
 - 1. Address: 6915 SW Macadam, Suite #200.
 - 2. City: Portland, Oregon 97219.
 - 3. Tel: 503-892-1188.
 - 4. Fax: 503-892-1190.
 - 5. Project Manager: Brendan Arnold.
 - 6. E-mail: BrendanA@MKE-Inc.com.

1.08 HVAC ENGINEER - DESIGN ASSIST

- A. Name: MKE & Associates.
 - 1. Address: 6915 SW Macadam, Suite #200.
 - 2. City: Portland, Oregon 97219.
 - 3. Tel: 503-892-1188.
 - 4. Fax: 503-892-1190.
 - 5. Project Manager: Brendan Arnold.
 - 6. E-mail: brendana@MKE-Inc.com.

1.09 ELECTRICAL ENGINEER - CONTRACTORS CONSULTANT

- A. Name: PAE Engineers.
 - 1. Address: 522 SW 5th Avenue #1500.
 - 2. City: Portland, Oregon 97204.
 - 3. Tel: 503-226-2921.
 - 4. Project Manager: Jarren Parthemer.
 - 5. E-mail: Jarren.Parthemer@pae-engineers.com.

1.10 ELECTRICAL ENGINEER - DESIGN ASSIST

- A. Name: MKE & Associates.

1. Address: 6915 SW Macadam, Suite #200.
2. City: Portland, Oregon 97219.
3. Tel: 503-892-1188.
4. Fax: 503-892-1190.
5. Project Manager: Steve Lockhart.
6. E-mail: Stevel@MKE-Inc.com.

1.11 LANDSCAPE ARCHITECT

- A. Name: Shapiro Didway, LLC.
1. Address: 1204 SE Water Ave., Suite 21.
 2. City: Portlan, OR 97214.
 3. Tel: 503.232.0520.
 4. Project Manager: Aaron West.
 5. E-mail: aaron@shapirodidway.com.

1.12 ENVELOPE CONSULTANT

- A. Name: Morrison Hershfield.
1. Address: 5100 SW Macadam Avenue, Suite 500.
 2. City: Portland, OR 97239.
 3. Tel: 503.924.2518.
 4. Project Manager: John Duncan.
 5. E-mail: jduncan@morrisonhershfield.com.

1.13 ACCESSIBILITY

- A. Name: Marx Okubo Associates, Inc.
1. Address: 444 Spear Street, Suite 205.
 2. City: San Francisco, CA 94105.
 3. Tel: 206.621.9122.
 4. Project Manager: Michael Silverman.
 5. E-mail: michael_silverman@marxokubo.com.

1.14 ACOUSTIC ENGINEER

- A. Name: ABD Engineering & Design.
1. Address: 321 SW 4th Ave, Suite 700.
 2. City: Portland, OR 97204.
 3. Tel: 503.444.5656.
 4. Project Manager: Melinda Miller.
 5. E-mail: mmiller@abdengineering.com.

END OF SECTION

SECTION 00 01 07.00
SEALS PAGE

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR .

1.02 ARCHITECT

- A. Architect's Name: Ankrom Moisan Architects, Inc.
 - 1. Portland Office:
 - a. 38 NW Davis, Suite 300, Portland, Oregon 97209.
 - b. Tel: 503-245-7100.
 - c. Fax: 503-245-7710.
 - 2. Principal In Charge: Isaac Johnson.
 - 3. Project Manager: Francis Dardis.
 - 4. Tel: 503.892.7304.
 - 5. E-mail: francisd@ankrommoisan.com.

END OF SECTION

**SECTION 00 01 07.01
SEALS PAGE - STRUCTURAL**

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR .

1.02 THE FOLLOWING SPECIFICATION SECTIONS HAVE BEEN PREPARED BY:

- A. Name: Stonewood Structural Engineers, Inc.
 - 1. Address: 4600 NW Camas Meadows Drive, Suite 2052001 NW 19th, Suite 103A.
 - 2. City: Portland, OR 97209.
 - 3. Tel: 360.216.1704.
 - 4. Project Manager: Scott Nyseth.
 - 5. E-mail: scott.nyseth@stonewoodstructural.com.
- B. Specification Table of Contents:

END OF SECTION

SECTION 00 01 07.02
SEALS PAGE - PLUMBING DESIGN ASSIST

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR .

1.02 THE FOLLOWING SPECIFICATION SECTIONS HAVE BEEN PREPARED BY:

- A. Name: MKE & Associates.
 - 1. Address: 6915 SW Macadam, Suite #200.
 - 2. City: Portland, Oregon 97219.
 - 3. Tel: 503-892-1188.
 - 4. Fax: 503-892-1190.
 - 5. Project Manager: Brendan Arnold.
 - 6. E-mail: BrendanA@MKE-Inc.com.
- B. Specification Table of Contents: See Section 00 01 00.

END OF SECTION

SECTION 00 01 07.03
SEALS PAGE - HVAC DESIGN ASSIST

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR .

1.02 THE FOLLOWING SPECIFICATION SECTIONS HAVE BEEN PREPARED BY:

- A. Name: MKE & Associates.
 - 1. Address: 6915 SW Macadam, Suite #200.
 - 2. City: Portland, Oregon 97219.
 - 3. Tel: 503-892-1188.
 - 4. Fax: 503-892-1190.
 - 5. Project Manager: Brendan Arnold.
 - 6. E-mail: brendana@MKE-Inc.com.
- B. Specification Table of Contents: See Section 00 01 00.

END OF SECTION

**SECTION 00 01 07.04
SEALS PAGE - ELECTRICAL DESIGN ASSIST**

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR .

1.02 THE FOLLOWING SPECIFICATION SECTIONS HAVE BEEN PREPARED BY:

- A. Name: MKE & Associates.
 - 1. Address: 6915 SW Macadam, Suite #200.
 - 2. City: Portland, Oregon 97219.
 - 3. Tel: 503-892-1188.
 - 4. Fax: 503-892-1190.
 - 5. Project Manager: Steve Lockhart.
 - 6. E-mail: SteveL@MKE-Inc.com.
- B. Specification Table of Contents: See Section 00 01 00.

END OF SECTION

SECTION 00 01 07.05
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GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR .

1.02 THE FOLLOWING SPECIFICATION SECTIONS HAVE BEEN PREPARED BY:

- A. Name: PAE Engineers.
 - 1. Address: 522 SW 5th Avenue #1500.
 - 2. City: Portland, Oregon 97204.
 - 3. Tel: 503-226-2921.
 - 4. Project Manager: Jarren Parthemer.
 - 5. E-mail: Jarren.Parthemer@pae-engineers.com.
- B. Specification Table of Contents: See Section 00 01 00.

END OF SECTION

SECTION 00 01 07.07
SEALS PAGE - CIVIL

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR .

1.02 THE FOLLOWING SPECIFICATION SECTIONS HAVE BEEN PREPARED BY:

- A. Name: BKF Engineers.
 - 1. Address: 2175 NW Raleigh Street, Suite 11, Office 2094.
 - 2. City: Portland, OR 97210.
 - 3. Tel: 503.553.5731.
 - 4. Project Manager: Jason White.
 - 5. E-mail: jwhite@bkf.com.
- B. Name: Janet Turner Engineering.
 - 1. Address: 16869 65th Ave #194.
 - 2. City: Lake Oswego, OR 97035.
 - 3. Tel: 541.510.0878.
 - 4. Project Manager: Janet Turner.
 - 5. E-mail: jturner@jturnerengineering.com.
- C. Specification Table of Contents: See Section 00 01 00.

END OF SECTION

**SECTION 00 01 07.08
SEALS PAGE - LANDSCAPE**

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR .

1.02 THE FOLLOWING SPECIFICATION SECTIONS HAVE BEEN PREPARED BY:

- A. Name: Shapiro Didway, LLC.
 - 1. Address: 1204 SE Water Ave., Suite 21.
 - 2. City: Portland, OR 97214.
 - 3. Tel: 503.232.0520.
 - 4. Project Manager: Aaron West.
 - 5. E-mail: aaron@shapirodidway.com.
- B. Specification Table of Contents: See Section 00 01 00.

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**SECTION 00 01 07.09
SEALS PAGE - ACOUSTICAL**

GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS.
- B. Address: 17160 West Baseline Road.
- C. City: Beaverton, OR.

1.02 THE FOLLOWING SPECIFICATION SECTIONS HAVE BEEN PREPARED BY:

- A. Name: ABD Engineering & Design.
 - 1. Address: 321 SW 4th Ave, Suite 700.
 - 2. City: Portland, OR 97204.
 - 3. Tel: 503.444.5656.
 - 4. Project Manager: Melinda Miller.
 - 5. E-mail: mmiller@abdengineering.com.
- B. Specification Table of Contents:

END OF SECTION

SECTION 00 31 00
AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:
- B. Geotechnical Report:
 - 1. A copy of a geotechnical report with respect to the building site is available for viewing:
 - a. Title: Report of Geotechnical Engineering Services Elmonica.
 - b. Date: January 12, 2022.
 - c. Prepared by: NV5 9450 SW Commerce Circle, Suite 300; Wilsonville, OR
 - 2. Original copy is available for inspection at Owner's offices during normal business hours.
 - 3. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
 - 4. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

**SECTION 00 50 00
CONTRACTING FORMS AND SUPPLEMENTS**

PART 1 GENERAL

1.01 AGREEMENT AND CONDITIONS OF THE CONTRACT

- A. The General Conditions are based on AIA A201, as amended.

1.02 FORMS

- A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.
- B. Clarification and Modification Forms:
 - 1. Architect's Supplemental Instructions Form: AIA G710.
 - 2. Construction Change Directive Form: AIA G714.
 - 3. Change Order Form: AIA G701.

1.03 REFERENCE STANDARDS

- A. AIA A201 - General Conditions of the Contract for Construction 2017.
- B. AIA G701 - Change Order 2017.
- C. AIA G710 - Architect's Supplemental Instructions 2017.
- D. AIA G714 - Construction Change Directive 2017.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

AIA[®] Document A201[™] – 2017

General Conditions of the Contract for Construction

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

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

Ankrom Moisan Architects, Inc.
38 NW Davis Street, Suite 300
Portland, OR 97209

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| 15 | CLAIMS AND DISPUTES |

ADDITIONS AND DELETIONS:

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

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

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

§ 1.2.1.2 In event of a conflict or discrepancy among the Contract Documents, interpretations will be based on the following priorities:

- a. Agreement.
- b. Addenda, with those of later date having precedence over those of earlier date.
- c. Supplementary Conditions.
- d. General Conditions of the Contracts.
- e. Schedules.
- f. Drawings and Specifications:
 - 1) In the case of inconsistency between Drawings and Specifications or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.
 - 2) Large Scale Drawings.
 - 3) Small Scale Drawings.
- g. Dimension numbers written on Drawings prevail and take precedence over Dimensions scaled from Drawings.

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.5.3 The Owner, through its Architect, may from time to time make certain base documents available in conventional or electronic media form to the Contractor and its subcontractors and consultants for use in preparing shop drawings and submittals or in providing professional design services or certifications required under the Contract Documents. Base documents shall be issued for the recipients' convenience only. Such base documents are not

Contract Documents, are not intended for use in construction, and may be used only at the users' risk subject to the Architect's reasonable restrictions and disclaimers.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement. Notices may also be served by telecopy or facsimile transmission, so long as the telecopy or facsimile transmission device generates an automatic confirmation of delivery, and shall be effective on receipt.

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

§ 1.7 Digital Data Use and Transmission

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

§ 1.8 Building Information Models Use and Reliance

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

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

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

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

§ 2.3 Information and Services Required of the Owner

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

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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

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

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

§ 3.3 Supervision and Construction Procedures

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

alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

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

§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 7 calendar days after first observance of the conditions. No adjustment in the Contract Time for Contract Sum shall be submitted or allowed, however, in connection with concealed or unknown conditions which do not differ materially from those conditions disclosed or which reasonably should have been disclosed by the Contractor's prior inspections, tests, reviews and preconstruction services for the Project.

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall provide the services of a competent on-site representative, from the commencement of construction to final completion and acceptance of the Work. The Contractor's on-site representative shall represent Contractor at the Work and all directions, instructions, or notices to the on-site representative given by the Owner or Architect shall be as binding as given to the Contractor. The Contractor's on-site representative shall be in charge of the Work at all times and shall have authority to furnish estimates and to approve minor changes in the Work. The Contractor shall not remove or replace its on-site representative without prior approval of the Owner.

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The construction schedule shall be in an appropriately

detailed precedence-style critical path method (CPM) type format which shall provide a graphic representation of activities and events that will occur during performance of the Work including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The Contractor shall perform the Work in accordance with the schedule as well as within the dates specified in this Agreement. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project. Periodically, as required by the Owner or the Architect, the Contractor shall report on the status of the Work on duplicate marked copies of the current schedule. The Contractor shall indicate in the status report any Work that is not proceeding according to the current schedule and shall provide a written plan of action to bring the Work into compliance with the schedule or to modify the schedule. Any modifications to the Contractor's schedule notwithstanding, the Contractor shall remain responsible to complete the Work within the time specified in this Agreement.

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

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

§ 3.11 Documents and Samples at the Site

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

(Paragraphs deleted)

§ 3.12.10. If professional design services or certification by a design professional related to systems, materials or equipment are required of the Contractor by the Contract Documents, the Contractor shall cause such services or certifications to be provided by properly licensed and insured design professionals whose signatures and seals shall appear on all drawings, calculations, specifications, certifications, shop drawings and other submittals prepared by such professionals. Each design professional providing such services shall carry professional errors and omissions insurance in an amount no less than \$1,000,000 unless lesser limits are allowed by Owner. Contractor shall be obligated to confirm that such coverage is maintained. Shop drawings and other submittals related to the Work or certified by such professionals, if prepared by others, shall bear such professionals' written approvals when submitted. The Owner and Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed by such design professionals consistent with the standards and criteria required under the Contract Documents.

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully

completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

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

§ 4.2.4 Communications

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

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

§ 4.2.6 The Architect may, on behalf of the Owner, reject Work that does not conform to the Contract Documents. The Architect may, on behalf of the Owner, require inspection or testing of the Work in accordance with subparagraphs 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed, or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and take appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples. The Architect's action shall be taken with such reasonable promptness to avoid delay in the Work in the activities of the Owner, Contractor or separate Contractors while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is conducted solely for their benefit and protection of the Owner and Contractor may not rely upon any such review as an acknowledgement or certification that the submittal is accurate, complete, or proposes work in compliance with all aspects of the Contract Documents or applicable law. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under paragraphs 3.3, 3.5 and 3.12. The Architect's review and Owner's acceptance shall not constitute approval of safety precautions or any construction means, methods, techniques, sequences or procedures. Acceptance of a specific item shall not indicate approval of an assembly of which the item is a component.

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

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

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

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

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

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

(Paragraph deleted)

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors.

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

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

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

§ 6.2 Mutual Responsibility

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

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

- 1 The change in the Work;
- 2 The amount of the adjustment, if any, in the Contract Sum; and
- 3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Agreement on any Change Order will constitute a final settlement of all matters relating to changes in the Work which are the subject of the Change order, including, but not limited to, all direct and indirect costs associated with such changes and any and all adjustments to the Contract Sum and the construction schedule.

§ 7.3 Construction Change Directives

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

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

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

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 § 7.3.7 If the Owner and the Contractor are unable to agree upon change order terms, or if in the opinion of the Architect the Work must proceed before an agreement can be negotiated, the Architect will order the Contractor to proceed with the changes, and the Contractor shall comply. In such an event, an adjustment shall be initially determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum,
(Paragraphs deleted)

a reasonable allowance for overhead and profit to be determined otherwise in accordance with the Contract Documents. In no event shall the Contractor proceed with changes in the Work without a written order from the Owner to so proceed. The Owner will be under no obligation to pay for unauthorized extra, additional, or changed Work performed by the Contractor without a written Change Order or other written order to proceed executed by the Owner.

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the

Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Owner determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Owner may determine. No such delay shall be recognized unless it alone increases the overall critical path duration of the schedule in effect at the time of delay.

(Paragraph deleted)

§ 8.3.2 No schedule extension shall be allowed for delay commencing more than seven (7) calendar days before notice of claim therefore is made in writing to the Owner. In case of a continuing delay, only one claim is necessary.

§ 8.3.3 No claim for delay shall be allowed the Contractor on account of the Architect's or Owner's failure to return drawings and shop drawings to the Contractor until ten (10) working days after Architect's receipt of a demand for such drawings, and not then, unless such claim is just and allowable as provided above. Disapproval of incomplete or defective submittals shall not be a claim for delay.

§ 8.3.4 The Owner may accelerate the schedule from time to time upon written direction to the Contractor to so accelerate. If the forces of the Contractor or any of its subcontractors are required to work overtime as a result of such acceleration, the Owner will reimburse the Contractor for the premium portion of overtime wages paid plus applicable federal and state payroll taxes and other actual payroll costs attributable to the overtime premium. Reimbursement for such acceleration shall not include any markup for overhead or profit of the Contractor or its subcontractors on the premium portion of overtime wages. No reimbursement will be allowed for overtime work which the Contractor is required to perform due to its own failure to otherwise meet the schedule or due to any other fault of the Contractor.

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

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

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 failure to carry out the Work in accordance with the Contract Documents.

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

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

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

§ 9.6 Progress Payments

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

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

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

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

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

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

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

§ 9.6.8 The Owner may condition any payment otherwise due to Contractor upon the Contractor's prior submission of unconditional lien waivers from subcontractors and suppliers covering any work for which Contractor has received payment from the Owner.

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

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so

that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted, less 200% of the value of the Work remaining to complete. If 200% of the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under

Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

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

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

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

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the

Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

§ 11.1.2 If the Contractor's required insurance is not described in the Agreement or elsewhere in the Contract Documents, as provided in § 11.1.1, then the Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

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

§ 11.1.2.1 The insurance required by subparagraph 11.1.2 shall be written for not less than the limits of liability provided below, unless otherwise specified in the Contract Documents, or required by law, whichever coverage is greatest.

1. Employers' liability -- \$ _____
2. Comprehensive commercial general liability insurance including premises/ operations, personal injury liability, blanket contractual liability, broad form property damage liability, products liability, completed operations liability, independent contractors and underground, explosion, and collapse hazards -- \$ _____ each occurrence, bodily injury and property damage combined,
3. Automobile liability on all owned, non-owned, and hired automobiles -- \$ _____ each occurrence, bodily injury and property damage combined.
4. Umbrella/ excess liability -- \$ _____ each occurrence, bodily injury and property damage combined.

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

§ 11.1.2.3 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.2.4 Deductible (self-insured) amounts under all required liability insurance policies shall be subject to approval by Owner and in the event of a claim against such policies, the deductible amount shall be paid by Contractor as part of the Cost of the Work.

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

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

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

§ 11.2 Owner's Insurance

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

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

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

§ 11.3 Waivers of Subrogation

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

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

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

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

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner. Except as provided in § 11.5.2, Owner shall not be liable for the result of any such settlement with insurers so long as such settlement is reached in good faith and Owner has conferred with Contractor on such settlement as provided in § 11.5.2.

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

out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

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

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

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

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

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

(Paragraph deleted)

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination. The Contractor shall not be entitled to recover consequential damages as a result of any of the events set forth in paragraph 14.1.1, which would be grounds for the Contractor to terminate. The total amount to which the contractor is entitled upon termination pursuant to paragraph 14.1.1 shall not exceed the Contract Sum, adjusted for change orders, less prior progress payments received.

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the

Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

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

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

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

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

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker.

If the Contractor claims that any instruction issued on behalf of the Owner after the effective date of this Agreement, by drawings or otherwise, involve extra costs under the Contract, Contractor shall not be entitled to reimbursement for such extra costs unless the Contractor so notifies the Architect and Owner in writing before proceeding with the affected Work and within seven (7) calendar days after receipt of such instructions. Claims and demands for any other cause, whatsoever, by the Contractor against the Owner must be served in writing upon the Architect and Owner within fourteen (14) calendar days from the occurrence of the cause giving rise to the claim. Timely compliance with the written notice requirements of this Agreement are a condition precedent to the Contractor's right to reimbursement of this Agreement are a condition precedent to the Contractor's right to reimbursement or payment on account of any claim or demand and failure to provide such notice shall constitute Contractor's waiver of such claim or demand.

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

§ 15.2 Initial Decision

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

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

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

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

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

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

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

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

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

§ 15.3 Mediation

§ 15.3.1 The Contractor and the Owner agree that any dispute that may arise under this Agreement will be submitted to a mediator agreed to by both parties as soon as such dispute arises, but in any event prior to commencement of arbitration or litigation. Such mediation shall occur at that place where the Project is located and the mediation fee and expenses shall be shared equally by the parties who agree to exercise their best efforts in good faith to resolve all disputes in mediation.

(Paragraphs deleted)

§ 15.4 Arbitration and Litigation

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: ELMONICA STATION APARTMENTS
 - 1. Address: 17160 West Baseline Road
 - 2. City: Beaverton, OR
- B. Owner's Name: Rembold Properties, LLC.
- C. Architect's Name: Ankrom Moisan Architects, Inc.
 - 1. Portland Office:
 - a. 38 NW Davis, Suite 300, Portland, Oregon 97209.
 - b. Tel: 503-245-7100.
 - c. Fax: 503-245-7710.
- D. The Project consists of the construction of (3) - 5 story residential buildings over slab-on-grade.
 - 1. Overall project 271,169 gross square feet.
 - 2. Units: Residential
 - a. Residential: 263 units located on floors 1 through 5 .
 - 3. One level of retail and amenity spaces are located in stand alone buildings .
 - 4. Parking: Occurs at grade level.
 - a. Stalls: 263 spaces total.
 - b. Accessory Areas: storage, trash, recycling, mechanical spaces, electrical spaces, and bike storage.
 - 5. Construction Type:
 - a. Residential Type: III-B.
 - b. Amenity / Retail Type: V-B.
 - c. Building to be fully automatic fire sprinklered with alarm system.

1.02 WORK BY OWNER

- A. PRODUCTS FURNISHED BY OWNER INSTALLED BY CONTRACTOR ARE IDENTIFIED AS FOIC
 - 1. Responsibilities:
 - a. Providing support systems to receive Owner's equipment, and mechanical and electrical connections.
 - b. Owner to arrange for and deliver necessary shop drawings, product data, and samples to Contractor.
 - c. Owner to arrange and pay for delivery of Owner furnished items according to Contractor's Construction Schedule.
 - d. If Owner furnished items are damaged, defective, or missing upon delivery, Owner to arrange for replacement.
 - e. Contractor to designate delivery dates of Owner furnished items in Contractor's Construction Schedule.
 - f. Contractor to review shop drawings, product data, and samples, and return to Architect noting discrepancies or problems anticipated in use of product.

- g. Contractor responsible for receiving, unloading, and handling Owner furnished items at site.
 - h. Contractor responsible for protecting Owner furnished items from damage, including damage from exposure to elements.
 - 1) Contractor shall repair or replace items damaged as result of his operations.
 - B. Owner will supply and install the following and noted as FOIO (furnished by Owner and installed by Owner) :
 - 1. Furniture..
 - 2. Telecommunication system..
 - 3. Security system..
 - C. Owner will supply the following for installation by Contractor and noted as FOIC (furnished by Owner and installed by Contractor):
 - 1. Responsibilities:
 - a. Providing support systems to receive Owner's equipment, and mechanical and electrical connections.
 - b. Owner to arrange for and deliver necessary shop drawings, product data, and samples to Contractor.
 - c. Owner to arrange and pay for delivery of Owner furnished items according to Contractor's Construction Schedule.
 - d. If Owner furnished items are damaged, defective, or missing upon delivery, Owner to arrange for replacement.
 - e. Contractor to designate delivery dates of Owner furnished items in Contractor's Construction Schedule.
 - f. Contractor to review shop drawings, product data, and samples, and return to Architect noting discrepancies or problems anticipated in use of product.
 - g. Contractor responsible for receiving, unloading, and handling Owner furnished items at site.
 - h. Contractor responsible for protecting Owner furnished items from damage, including damage from exposure to elements.
 - i. Contractor shall repair or replace items damaged as result of his operations.

1.03 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.

1.04 CONTRACTOR USE OF SITE AND PREMISES

- A. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- B. Existing Building: Maintain existing building in a weathertight condition throughout construction period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.

1.02 DEFINITIONS

- A. Architect's Supplemental Instructions (ASI):
 - 1. Architect's written order of instruction to Contractor, signed by Architect, which authorizes minor changes in Work that do not change Contract Sum or Contract Time.
- B. Proposal Request (PR):
 - 1. Initiated by Architect: Written request by Architect to Contractor to quote change to Contract Sum and/or Contract Time for proposed change to Contract Documents.
 - 2. Initiated by Contractor: Written request by Contractor to Architect proposing change to Contract Documents accompanied with quotation for change to Contract Sum and/or Contract Time.
- C. Construction Change Directive (CCD):
 - 1. Written order prepared by Architect, signed by Owner and Architect, directing Contractor to proceed with change to Contract Documents which affect Contract Sum and/or Contract Time, for subsequent inclusion in a Change Order after change to Contract Sum and/or Contract Time has been determined.
- D. Change Order (CO):
 - 1. Prepared by Architect and signed by Owner, Contractor, and Architect stating their agreement to a change to Contract Documents and adjustment to Contract Sum and/or Contract Time.

1.03 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.
- D. Correlate line items in Schedule of Values with other required administrative schedules and forms, including:
 - 1. Contractor's Construction Schedule.
 - 2. Application for Payment forms, including Continuation Sheets.
 - 3. List of Subcontractors, principle suppliers, and fabricators.

4. Schedule of allowances.
 5. Schedule of alternates.
 6. List of products.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
1. Identification: Include following Project identification on Schedule of Values:
 - a. Project name and address.
 - b. Name of Architect.
 - c. Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange Schedule of Values in tabular form with separate columns to indicate following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value; Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 3. Provide a breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports.
 4. Round amounts to nearest whole dollar; total to equal Contract Sum.
 5. Provide a separate line item for each part of Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
 6. Update and resubmit Schedule of Values prior to next Applications for Payment when Change Orders or Construction Change Directives result in a change in Contract Sum.
- F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Present required information in typewritten form.
- E. Form: AIA G702 Application and Certificate for Payment and AIA G703 - Continuation Sheet including continuation sheets when required.
- F. Initial Application for Payment:
 1. Administrative actions and submittals that must precede or coincide with this application include following:

- a. List of subcontractors.
 - b. List of principal suppliers and fabricators.
 - c. Schedule of Values.
 - d. Contractor's Construction Schedule.
 - e. List of Contractor's staff assignments.
 - f. List of Contractor's principal consultants.
 - g. Copies of building permits.
 - h. Initial progress report.
 - i. Report of preconstruction meeting.
 - j. Certificates of insurance and insurance policies.
 - k. Performance and payment bonds.
 - l. Data needed to acquire Owner's insurance.
- G. Application for Payment at Substantial Completion: Following issuance of Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of Work.
 2. Administrative actions and submittals that must precede or coincide with this application include following:
 - a. Occupancy permits and similar approvals.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Final cleaning.
 - f. Application for reduction of retainage and consent of surety.
 - g. Advice on shifting insurance coverage.
 - h. List of incomplete Work recognized as exceptions to Architect's Certificate of Substantial Completion.
- H. Final Payment Application:
1. Administrative actions and submittals that must precede or coincide with this application include following:
 - a. Completion of Project closeout requirements.
 - b. Completion of items specified for completion after Substantial Completion.
 - c. Ensure that unsettled claims will be settled.
 - d. Ensure that incomplete Work is not accepted and will be completed without undue delay.
 - e. Transmittal of required Project construction records to Owner.
 - f. Proof that taxes, fees, and similar obligations were paid.
 - g. Removal of temporary facilities and services.
 - h. Removal of surplus materials, rubbish, and similar elements.
 - i. Change of door locks to Owner's access.
- I. Execute certification by signature of authorized officer.
1. Complete every item of form. Include notarization and execution by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

- a. Match entries with data on Schedules of Values.
 - b. Include amounts of Change Orders and Construction Change Directives issued prior to last day of construction period covered by application.
- J. Submit one electronic and three hard-copies of each Application for Payment.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- C. Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing Architect's supplemental instructions (ASI) on AIA Form G710 or other similar form designated by Architect.
- D. Architect's Supplement Instructions (ASI).
1. Architect's Supplemental Instructions may include supplementary or revised Drawings and/or Specifications to describe minor changes.
- E. Construction Change Directive (CCD): Architect may issue a a directive, on AIA Form G714 Construction Change Directive or other similar form designated by Architect, signed by Architect, instructing Owner to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 2. Construction Change Directive may include supplementary or revised Drawings and/or Specifications to describe change to the Contract Documents
 3. Promptly execute the change.
 4. Both Owner and Architect will sign and date a Construction Change Directive which directs the Contractor to proceed with change to the Contract Documents prior to determination of cost and/or time.
 5. Contractor shall submit to Architect itemized change to Contract Sum and/or Contract Time within 10 working days when possible, and no more than 30 calendar days, except for the following conditions:
 - a. Unit prices have been agreed upon and quantities cannot be determined until work described in the CCD has been completed.
 - b. Owner has agreed that Contract Sum and/or Contract Time of can be determined at completion of work described in the CCD.
 6. When Owner, Architect, and Contractor concur on change to Contract Sum and/or Contract Time, as described in the General Conditions for "Construction Change Directives," the change to Contract Sum and/or Contract Time will be included in a Change Order.

7. Construction Change Directive is issued in lieu of a Proposal Request when time is of the essence and change to Contract Sum and/or Contract Time cannot be determined prior to start of the work.
- F. Proposal Request (PR): Architect may issue a document which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.
1. Proposal Request is a request for information only, and is not an instruction or authorization to execute the change, or an order to stop Work in progress.
 2. Proposal Request may include supplementary or revised Drawings and/or Specifications to describe a proposed change to Contract Documents.
- G. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.
1. Proposal Request is for a change in the Work accompanied by a detailed quotation of impact on Contract Sum and/or Contract Time.
 2. Proposal Request may include revised Drawings and/or Specifications to describe a proposed change to Contract Documents.
 3. Proposal Request is a request for information only, and does not authorize the Contractor to execute the change or stop Work in progress without the Architect's and Owner's authorization.
 4. Contractor initiated Proposal Requests may take the form of a "Claim" where Contractor finds it necessary for proper execution of the Work, to propose a change in the Work that is not shown or indicated in Contract Documents, and may affect Contract Sum and/or Contract Time, which for which no Proposal Request or Construction Change Directive has been issued by the Architect.
 - a. Contractor's determination that Architect's response to an RFI which affects Contract Sum and/or Contract Time may be addressed by Contractor in a Proposal Request.
 5. Architect shall respond to Contractor initiated proposals within 10 working days following receipt of Proposal Request.
- H. Change Orders (CO):
1. Architect will prepare each Change Order utilizing AIA Document G701, or other similar form acceptable to Owner.
 2. Stipulated Sum Change Order: Based on Proposal Request or Notice of Change and Contractor's price quotation or Contractor's request for a Change Order as approved by Architect.
- I. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.

3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
 5. Proposal Requests approved for change to Contract Documents by Owner and Architect that have not been converted to a Construction Change Directive.
 6. Construction Change Directive where Owner, Architect, and Contractor have agreed to change in Project Contract Sum and/or Contract Time.
 7. Changes to Project Contract Sum and/or Contract Time that have not been documented by Proposal Request or Construction Change Directive, but have been agreed upon by Owner, Architect, and Contractor.
- J. Substantiation of Costs: Provide full information required for evaluation.
1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 - e. Products, with quantities used and unit cost, including purchase source.
 - f. Taxes, Insurance, and Bonds.
 - g. Credit for deleted work where applicable with same documentation as required for cost increases for additional work.
 - h. Overhead and profit, determined after credits have been deducted from additions.
 - i. Justification for change in Contract Time
 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
 4. Claims for Work not authorized through Proposal Requests or Construction Change Directives:
 - a. Provide supporting documentation for each claim for additional cost as indicated above for cost and time quotations with the following additional information:
 - b. Name of Owner's authorized agent who ordered work, and date of Order.
 - c. Dates and hours work performed, and by whom.
 - d. Timecard records, including summary of hours worked, and hourly rates paid.
 - e. Receipts and invoices for products used including quantities and unit costs.
 - f. Receipts and invoices for equipment utilized, including dates and time of use.
 - g. Provide the same documentation indicated above for subcontracts same as required for Contractor's own forces.
- K. Unit Price Change Order:

1. For pre-determined unit prices and quantities, Change Order will be executed on a fixed unit price basis.
 2. For unit costs or quantities of units of work which are not pre-determined, execute work under a Construction Change Directive.
 3. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.
- L. Time and Material Change Order:
1. Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of Contract.
 2. Architect will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
 3. Maintain detailed record so work done on Time and Material basis.
 4. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in work.
- M. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- N. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- O. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- P. Promptly enter changes in Project Record Documents.
- Q. Document requests for Product substitutions according to requirements of Section 01 60 00.

1.06 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. Application for Final Payment will not be considered until the following have been accomplished:
 1. All closeout procedures specified in Section 01 70 00.

1.07 CORRELATING CHANGE ORDERS WITH OTHER REQUIREMENTS

- A. Revise Schedule of Values and Applications for Payment to record each Change Order as separate item of work with adjustment to Contract Sum and Contract Time as described herein.
- B. Revise Construction Schedule to reflect each change in Contract Time.
- C. Revise Subschedules to show changes for other items of work affected by modifications to Contract Documents.
- D. Record modifications in Record Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 23 00
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.

1.02 DEFINITIONS

- A. Alternate: Amount proposed by bidders and stated on Bid Form for specific work defined in Bidding Documents that shall be added to or deducted from Base Bid amount if Owner elects to accept a corresponding change in scope of work for products, materials, equipment, systems or installation methods as described in Contract Documents.
 - 1. Cost or credit for each Alternate is net addition to or deduction from Contract Sum to incorporate Alternate into Work.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternatives quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option.
 - 1. Owner reserves right to select any Alternates up to thirty calendar days after award of Contract unless otherwise stated in Bidding Requirements.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.
 - 1. Include miscellaneous devices, appurtenances, incidental items and labor, materials, tools, equipment, rigging, etc. as required for complete installation whether or not described as part of Alternate.
 - 2. When Owner has made a decision on which, if any, of Alternates will be selected, notify in writing each party involved which Alternates have been selected, rejected, or deferred.
- C. Execute Alternates under same conditions as other Work of this Contract.

1.04 SCHEDULE OF ALTERNATIVES

- A. Alternative No. 01 - Residential Corridors.
 - 1. Base Bid: Carpet Tile CT-3 per Section 09 06 02 Materials and Finishes Schedule.
 - 2. Alternative: Price RFT-1 Resilient Flooring Tile per Section 09 06 02 Materials and Finishes Schedule.
- B. Alternative No. 02 - Residential Unit Entry.
 - 1. Base Bid: Install WD-2 at Unit Entry per interior elevations and Section 09 06 02 Materials and Finishes Schedule.
 - 2. Alternative: Price PL-2 per Section 09 06 02 Materials and Finishes Schedule as alternative to WD-2.
- C. Alternative No. 03 - Residential Unit Entry.
 - 1. Base Bid: Install Unit entry door head panel as detailed in 14/A10.01-2
 - 2. Alternative: Remove entry door head panel and install gypsum wall board per interior wall assemblies.

D. Alternative No. 04 - Elevator Lobby.

1. Base Bid: Install WD-2 &WD-3 Paneling as scheduled and detailed.
2. Alternative: Price PL-2 as an alternative to WD-2 and PL-11 as an alternative to WD-3

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Contract documents precedence.
- E. Pre-Installation Meeting.
- F. Progress meetings.
- G. Request for Information (RFI)
- H. Construction progress schedule.
- I. Progress photographs.
- J. Coordination drawings.
- K. Submittals for review, information, and project closeout.
- L. Number of copies of submittals.
- M. Requests for Interpretation (RFI) procedures.
- N. Submittal procedures.
- O. Layout of work.
- P. Field engineering.

1.02 DEFINITIONS

- A. Coordination Drawings:
 - 1. Show relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in space provided or to function as intended.
- B. Product Data:
 - 1. Printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
- C. Samples:
 - 1. Partial sections of manufactured or fabricated components, cuts or containers of material, color range sets, and swatches showing color, texture, and pattern.
- D. Field samples:
 - 1. Full-sized physical examples erected on-site to illustrate finishes, coatings, or finish materials.
 - 2. Samples used to establish standard by which Work will be judged.
- E. Mockups:

1. Full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.
2. Approved mockups will be used to establish standard by which Work will be judged and maybe allowed to remain as part of the permanent Work.

1.03 CONTRACT DOCUMENTS PRECEDENCE

- A. In event of conflict or discrepancy among the Contract Documents, interpretations will be based on the following order of priorities:
 1. Agreement
 2. Addenda, with those of later date having precedence over those of earlier date.
 3. Supplementary Conditions.
 4. General Conditions of the Contracts.
 5. Schedules.
 6. Drawings & Specifications.
 - a. In the case of inconsistency between Drawings and Specifications or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.
 - b. Large Scale Drawings.
 - c. Small Scale Drawings.
 7. Dimension numbers written on Drawings prevail and take precedence over Dimensions scaled from Drawings.

1.04 PROJECT COORDINATOR

- A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of The Work.
 1. Schedule construction operations in sequence required to obtain best results where installation of one part of Work depends on installation of other components.
 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 3. Coordinate storage or staging areas for all trades.
- B. Administrative Procedures:
 1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work.
 2. Administrative activities include, but are not limited to:
 - a. Preparation of Schedules.
 - b. Installation of temporary facilities.
 - c. Delivery and processing of submittals.
 - d. Progress meetings.
 - e. Project closeout activities.
- C. Staff Names: Within 15 days of commencement of construction operations, submit a list of Contractor's principal staff assignments, including superintendent and other personnel involved in daily Project activities.
 1. Identify individuals, their duties and responsibilities.
 2. List personnel addresses and telephone numbers.

- D. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
- E. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. Contractor and Architect are required to use this service.
 - 3. It is Contractor's responsibility to submit documents in allowable format.
 - 4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
 - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 - 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 - 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Submittal Service: The selected service is:
 - 1. Newforma Info Exchange:
 - a. Project access: Invitation to be provided by Architect.
- C. Training: Web-based video tutorials are available on the site.
- D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. Schedule a meeting after notice to proceed.
- B. Schedule meeting at a time convenient to Owner and Architect, but not later than 15 days after Notice of Award.
 - 1. Hold conference at Project site or other convenient location.

- C. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Superintendent.
 - 5. Subcontractors.
 - 6. Manufacturer's Technical Representative.
 - 7. Building Envelope Consultant.
 - 8. Manufacturers deemed necessary by Contractor and Architect.
- D. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Designation of personnel representing the parties to Contract and Architect.
 - a. Emergency off-hour contacts.
 - 6. Routing of correspondence.
 - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 8. Scheduling.
 - a. Critical work sequencing.
 - b. Product Submittal Schedule.
 - 9. Purpose of Request for Interpretation (RFI):
 - a. Determine information not included in Contract Documents.
 - b. RFI is not intended to address items noted in paragraph below: REQUESTS FOR INTERPRETATION (RFI)
 - c. Provide sample of RFI Form and Cover Sheet for approval by Architect prior to meeting.
- E. 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.

3.03 PRE-INSTALLATION MEETING

- A. Conduct Pre-Installation Conference before each activity that requires coordination with other construction activities. Specification Sections requiring Pre-Installation Conferences include:
 - 1. 03 30 13 - Cast-In-Place Concrete Architectural
 - 2. 05 12 00 - Structural Steel
 - 3. 05 50 00 - Metal Fabrications
 - 4. 07 14 00 - Fluid-Applied Waterproofing (FAWP)
 - 5. 07 18 00 - Traffic Coatings (TC)
 - 6. 07 18 14 - Deck Coatings
 - 7. 08 71 00 - Door Hardware
 - 8. 08 80 00 - Glazing
- B. Attendance Required:

1. Owner.
 2. Architect.
 3. Contractor.
 4. Building envelope consultant.
 5. Installer foreman.
 6. Subcontractors affected by installed work.
 7. Manufacturer's technical representative.
 8. Code enforcement personnel, if required by local codes (example: Section 07 84 00, Firestopping).
- C. Notifications:
1. Notify attendees of scheduled Conference a minimum of 7 calendar days in advance of the conference.
- D. Agenda:
1. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
 2. Designation of personnel representing the parties in Contract, Owner, and the Architect.
 3. Procedures and processing of field decisions, submittals, and substitutions.
 4. Scheduling.
 5. Scheduling and preparation for activities of other trades.
 6. Review progress of time schedules, manufacturer's preparation and installation recommendations, safety requirements, weather limitations, substrate acceptability, compatibility problems, and inspection and testing requirements.
 7. Review progress of other construction activities and preparations for particular activity under consideration, including requirements for following:
 - a. Contract Documents and related Change Orders.
 - b. Shop Drawings, Product Data, and Quality Control Samples.
 - c. Details
 - d. Mockups.
 - e. Possible conflicts or compatibility problems.
 - f. Weather limitations.
 - g. Manufacturer's preparation and installation recommendations.
 - h. Warranty requirements.
 - i. Substrate acceptability.
 - j. Governing regulations.
 - k. Inspecting and testing requirements.
 - l. Protection.
 8. Record significant discussions, agreements, and disagreements of each conference. It is recommended that this meeting be held either preceding or following a Progress Meeting.
 - a. Number and record meetings sequentially.
 - b. Distribute meeting record to concerned parties, including Architect and Owner, within 72 hours after meeting.
- E. Do not proceed with installation if meeting cannot be successfully concluded.
1. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.

3.04 PRE-INSTALLATION MEETING - ACCESSIBILITY REVIEW

- A. Conduct a pre-installation meeting after wall layout is complete on floor and prior to any wall framing erection to discuss accessibility reviews, any special accessibility requirements to project, items that have different opinions of accessibility and constructibility issues. Will include outlet locations, tolerance given for dimensions, and answer questions.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Accessibility Consultant.
 - 5. Framing subcontractor.
 - 6. Electrical subcontractor.
 - 7. Plumbing subcontractor.
 - 8. Superintendent.
- C. Notifications:
 - 1. Notify attendees of scheduled conference a minimum of 7 calendar days in advance of meeting.
- D. Agenda (to be prepared by the Architect):
 - 1. Introductions.
 - 2. Review goals of the meeting.
 - 3. If third party hired for inspections: discussion of inspections, timing of inspections, and who will attend inspections.
 - 4. Review of most common issues.
 - 5. Differences of professional opinion.
 - 6. Questions.

3.05 PRE-INSTALLATION MEETING - UNIT ELECTRICAL SWITCH AND OUTLET BOX WALK

- A. Conduct a preinstallation box walk through each Unit Type locating electrical light switch, outlet boxes, low-voltage boxes, and thermostat boxes prior to installation electrical switches, outlets, conductors, low voltage wiring or thermostats.
 - 1. Layout to include the taped cabinet layout on the floor.
 - 2. Balance of Work within Units will be based on agreement from this box walk.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Accessibility Consultant.
 - 5. Electrical Sub-contractor.
 - 6. Superintendent.
- C. Notifications:
 - 1. Notify attendees of scheduled Conference a minimum of 7 calendar days in advance of meeting.

- D. Agenda:
 - 1. Confirm box location per Contract Documents and as required Building Code Accessibility requirements.
 - 2. Identification of appliances, cabinets, or other future work that will affect accessibility of outlets, switches, or other electrical items.
 - 3. Document initial location boxes has been acceptable to attendees. Notate how non-acceptable work will be corrected or an alternative agreed solution has been developed.
- E. Do not proceed with electrical work until this box walk has occurred and parties are in agreement.

3.06 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect, as requested.
 - 4. Contractor's superintendent.
 - 5. Major subcontractors.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to work.
- E. Record minutes and distribute copies within three days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.07 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 32 16

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
 - 1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

2. Include Product Submittal Review Schedule, provide date of submittal, length of design team review and resubmittal time.
 3. Submittals submitted prior to an approved Product Submittal Schedule will be returned without action.
- B. Provide updated schedule at each OAC meeting.

3.08 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. In addition to periodic, recurring views, take photographs of each of the following events:
1. Foundations in progress and upon completion.
 2. Structural framing in progress and upon completion.
 3. Enclosure of building, upon completion.
 4. Final completion, minimum of ten (10) photos.
- D. Views:
1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
 2. Consult with Architect for instructions on views required.
 3. Provide factual presentation.
 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- E. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email.
 2. File Naming: Include project identification, date and time of view, and view identification.
 3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
 4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.09 COORDINATION DRAWINGS

- A. Prepare coordination drawings where coordination is needed for installation of products and materials fabricated by separate entities.
1. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
- B. Review drawings prior to submission to Architect.

3.10 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition:
1. A request for interpretation (RFI) will not impact time and/or cost. If the Contractor believes the response will impact time and/or cost, see 3.10.G.
 2. A request for interpretation (RFI) is seeking one of the following:

- a. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Provide a proposed solution.
 - c. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare using software provided by the Electronic Document Submittal Service.
 3. Combine RFI and its attachments into a single electronic file. PDF format is required.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 - e. Documenting field conversations.
 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 1. Number RFI's sequentially from "001".
 2. Record each RFI in a log, identifying each by RFI-#, subject, date submitted, date of response, and disposition. Update and distribute log at project meetings.
 3. Indicate current status of every RFI. Update log promptly and on a regular basis.
 4. Note dates of when each request is made, and when a response is received.

5. Highlight items requiring priority or expedited response.
- F. Review Time: Architect will respond and return RFIs to Contractor within 10 calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- G. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.11 SUBMITTAL SCHEDULE

- A. Within 20 days after date of Agreement, submit preliminary schedule, including Product submittal Schedule.
- B. Submittals approved prior to ordering products or systems.
- C. Submit to Architect for review and approval, a schedule for submittals in tabular format.
 1. Coordinate with Contractor's construction schedule and schedule of values.
 2. Adjust submittal schedule to correspond with adjustment made to the construction schedule.
 - a. Schedule submittals so as to allow for a reasonable amount of time for Architect to process and review.
 3. Format schedule to allow tracking of status of submittals throughout duration of construction.
 4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
 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.

3.12 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system.
- B. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required or proposed for Work, clearly mark copies to indicate applicable information.
- C. Include following information:
 - 1. Manufacturer's printed recommendations.
 - 2. Compliance with trade association standards.
 - 3. Compliance with recognized testing agency standards.
 - 4. Performance characteristics and capacities.
 - 5. Notation of dimensions verified by field measurement.
 - 6. Required clearances, wiring and piping diagrams, and controls.
 - 7. Manufacturer's standard schematic drawings and diagrams, modified as required to suit Project requirements.
 - a. Do not reproduce Contract Documents to create shop drawings, but provide drawings that show actual conditions using specified products.
 - 8. Notation of coordination requirements.
- D. Colors and Patterns:
 - 1. Except where specific color and pattern is indicated in Contract Documents, and whenever a choice of color or pattern is available in specified products, submit 2 color and pattern charts to Architect for selection.
- E. Submit following for each required submittal:
 - 1. Electronic copy for Architect.
 - 2. Number of copies as required for Maintenance manuals.
 - 3. Number of copies as required by Contractor for distribution.
- F. Architect will retain a copy and return one electronic copy, marked with action taken and corrections or modifications required, to Contractor for distribution.
 - 1. Contractor to retain number of copies required for maintenance manuals.
 - 2. Do not permit use of unmarked copies of Product Data in connection with construction.

3.13 SAMPLES

- A. Submit Samples for review of size, kind, color, pattern, and texture, and to illustrate functional and aesthetic characteristics of Product, clearly mark samples to indicate applicable information.
- B. Where variation in color, pattern, or texture, or other characteristic is inherent in material or product represented, submit at least 3 multiple units that show approximate limits of variations, or number of units indicated in individual specification Sections.
- C. Field Samples: Full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish Project standard.

3.14 QUALITY ASSURANCE SUBMITTALS

- A. Submit quality control submittals, including:
 - 1. Design data

2. Certifications
 3. Manufacturer's instructions
 4. Manufacturer's field reports
 5. Other quality control submittals required under individual Technical Specifications of Project Manual.
- B. Certifications: Where individual Technical Specifications Sections of Project Manual require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from manufacturer certifying compliance with specified requirements.
1. Certification to be signed by an officer of manufacturer or other individual authorized to sign documents on behalf of company.

3.15 DESIGN DRAWINGS: DELEGATED DESIGN COMPONENTS

- A. Make design Drawings accurately to a scale sufficiently large to show pertinent aspects of item and its method of connection to Work.
- B. Provide structural calculation stamped by structural engineer registered in state work is being performed.
- C. Refer to Section 01 35 25 Delegated Design Requirements for additional information.

3.16 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit in a single bookmarked PDF 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 78 00 - Closeout Submittals.

3.17 SUBMITTALS FOR INFORMATION

- A. Submittals for Information shall be retained by Contractor at job site.
- B. 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 written instructions.
 6. Manufacturer's field reports.
 7. Coordination Drawings.
 8. Other types indicated.

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

3.18 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 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.19 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.
- B. Samples: Submit the number specified in individual specification sections; two of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.
 - 3. Additional number of samples as required by Contractor for distribution.
 - a. Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of Work.
- C. Copies will be returned, marked with Architect's action taken and corrections or modifications required, to Contractor for reproduction and distribution.
 - 1. Do not permit use of unmarked Shop Drawings in connection with construction.

3.20 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 - 3. Transmit using approved form.
 - a. Use Contractor's form, subject to prior approval by Architect.
 - 4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - a. Retain numbering system throughout revisions with addition of sequential letters for each revision to initial submittal.
 - b. Submittals more than 10 pages shall be bookmarked on major sections.
 - 5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

6. 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.
 - b. Identify deviations from Contract Documents, and Product or system limitations which may be detrimental to successful performance of completed Work.
 - c. Architect will return submittals without action if Contractor has not coordinated submittal and applied signature prior to transmittal to Architect.
 7. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 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 7 days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
 8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 9. Provide space for Contractor and Architect review stamps.
 10. When revised for resubmission, identify all changes made since previous submission.
 11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 13. Submittals not requested will not be recognized or processed.
- B. Re-submittals shall clearly identify all revisions to previous submittals.
1. Heavy ink clouded outlines (revision clouds) shall be drawn around revised areas of individual sheets.
 2. Architect/Engineer will not review information outside of revision clouds on resubmitted drawings.
- C. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. Do not submit (Material) Safety Data Sheets for materials or products.
- D. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- E. 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.
- F. Coordination:
1. Coordinate preparation and processing of submittals with performance of construction activities.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - 1) Transmit each submittal sufficiently in advance to avoid delay of related construction activities.
 2. Coordinate transmittal of submittals for related elements of Work so processing will not be delayed by need to review submittals concurrently for coordination.
 - a. Architect reserves right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
 - b. Partial submittals may be rejected as not complying with these provisions of Contract.
 3. Coordinate and ensure that no Work is performed that is involved with submittal until receiving Architect's stamped and signed approval.
 4. Architect will not accept submittals received from sources other than Contractor.
 5. Reference submittal to pertinent Contract Drawing sheet and detail number(s), and Contract Specification Section number on Cover Sheet and Submittal
 6. Submit items pertaining to only one Specification Section in each submittal.
- G. Submittal log:
1. Submit submittal log listing all submittals and date to be submitted at first construction meeting.
 2. Submit log itemizing project submittals and project submission date one week prior to first submittal.
 3. Identify each submittal.
 4. Maintain an accurate submittal log for duration of Work, showing current status of submittals at all times.
 5. Log to be reviewed at weekly meeting.
 - a. Make log available to Owner and Architect for review upon request.

3.21 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

3.22 ARCHITECT'S ACTION

- A. Except for submittals for record or information, where action and return is required, Architect will review each submittal, mark to indicated action taken, and return to Contractor.
- B. Submittals for Review Action Stamp: Architect will stamp each submittal with an action stamp, and mark stamp appropriately to indicate action taken, as follows:

1. NO EXCEPTION TAKEN:
 - a. Final Unrestricted Release: Work covered by submittal may proceed provided it complies with requirements of Contract Documents.
 - b. Final payment depends on that compliance.
2. MAKE CORRECTIONS NOTED:
 - a. Final-But-Restricted Release: Work covered by submittal may proceed provided it complies with corrections on submittal and requirements of Contract Documents.
 - b. Final payment depends on that compliance.
3. REVISE AND RESUBMIT:
 - a. Returned for Resubmittal: Do not proceed with Work covered by submittal, including purchasing, fabrication, delivery, or other activity.
 - b. Revise or prepare a new submittal according to notations and resubmit. Repeat as necessary to obtain a mark releasing submittal.
 - c. Do not use, or allow others to use, submittals marked REVISE AND RESUBMIT, at Project site or elsewhere where Work is in progress.
4. REJECTED:
 - a. Rejected from use: Work or product covered may NOT proceed or be used.
5. SUBMIT SPECIFIED ITEM:
 - a. Contractor to submit specified product.
6. NO ACTION TAKEN:
 - a. Work covered by submittal may proceed provided it complies with requirements of Contract Documents.
 - b. Final payment depends on that compliance.
- C. Submittals for Information Action Stamp: Architect will stamp each submittal with an action stamp, and mark stamp appropriately to indicate action taken, as follows:
 1. Architect's and consultants' actions on items submitted for information:
 2. RECEIVED: Items for which no action was taken:
 - a. Notify the Contractor that the submittal has been received for information only.
 3. REVIEWED: Items for which action was taken:
 - a. No further action is required from Contractor.
 4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, Architect will return submittal marked RECORD DOCUMENT.
- D. Submittals for Closeout Action Stamp:
 1. CLOSEOUT SUBMITTAL: Submit at Closeout.
- E. Delegated Design Component Review:
 1. Architect will stamp submittal after it has been reviewed by Contractor.
 2. Actions as specified under Action Stamp apply in addition to the following:
 - a. REVIEWED FOR COMPATIBILITY WITH THE DESIGN OF THE BUILDING.
 - b. REVIEWED TO DETERMINE WHETHER SYSTEMS, MATERIALS OR EQUIPMENT ARE DESIGNED IN CONFORMANCE WITH THE PERFORMANCE AND DESIGN CRITERIA AND THE DESIGN CONCEPT EXPRESSED IN THE CONTRACT DOCUMENTS.
- F. Design/Build Submittals Action Stamp:
 1. Architect will stamp submittal after it has been reviewed by Contractor.
 - a. REVIEWED FOR COMPATIBILITY WITH THE DESIGN OF THE BUILDING.

- b. NO ACTION TAKEN:
 - 1) Work covered by submittal may proceed provided it complies with requirements of Contract Documents.
 - 2) Final payment depends on that compliance.

G. Unsolicited Submittals: Architect will return unsolicited submittals to sender without action.

3.23 LAYOUT OF WORK

- A. Survey and verify conditions of project site.
- B. Record existing conditions prior to construction for comparison with Contract Documents.
 - 1. Report conflicts to Architect prior to start of Work.
 - 2. Architect will provide revisions to Contract Documents or issue instructions to deal with conflicts.
 - 3. Be responsible for remedying conflicts which could have been prevented by timely reviews of existing conditions.
 - 4. Remedies, which vary from Contract Documents shall be approved by Architect's and Owner's Representatives.

3.24 FIELD ENGINEERING

- A. Engineering Services:
 - 1. Provide field engineering services as required for construction.
 - 2. Locate and maintain an accurate benchmark on or near site which has been established by a Registered Surveyor.
 - a. Relate subsequent elevations of finish grades and building elements directly to this benchmark.
- B. Existing Control Points:
 - 1. Protect control points prior to starting Work, and preserve permanent reference points during construction.
 - 2. Make no changes or relocations of control points without prior written notice to Architect's Representative.
 - 3. Report to Architect's Representative when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- C. Instrument Layout:
 - 1. Using site bench marks and existing elevation control points, establish lines and levels, located and laid out by survey instrumentation.
 - 2. Locate water supply, storm and sanitary sewer lines.
 - 3. Locate edge and level of paving, curbs, walks, and sloping landscape.
 - 4. Locate building foundations, column locations, and floor levels.
 - 5. Locate controlling lines and levels required for plumbing, mechanical and electrical Work within 5 feet of building perimeter.
- D. Corrections:
 - 1. Record changes in elevations or location of Work on project record Documents.
 - 2. Report errors in horizontal and vertical dimensions and grades prior to starting Work.
- E. Verification:

1. Verify dimensions of new and existing Work.
 - a. If field measurements differ slightly from Drawings, modify to accommodate. If field measurements differ significantly, notify Architect prior to commencing Work.
 2. Coordinate locations of openings through floors, roofs and walls with Architectural, Mechanical and Electrical Drawings.
- F. Documentation:
1. Submit documentation to verify accuracy of field engineering Work when requested by Architect.

END OF SECTION

**SECTION 01 35 25
DELEGATED DESIGN REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for portions of work under this Contract that are Delegated Design.
- B. Contractor's responsibilities: Coordinate and assume or assign to subcontractors complete responsibility for design, shop drawings, calculations, submittals, permits, fabrication, transportation and installation.
 - 1. Submit and coordinate Delegated Design documents to jurisdiction having authority for separate permit.
 - 2. Fill out Delegated Design SUMMARY SHEET.
 - 3. Delegated Design components of Work are defined as: Complete, operational systems, provided and installed for their intended use.

1.02 DEFINITIONS

- A. DELEGATED DESIGN is any system or component engineered for the Project by the Contractor or Sub-Contractors with a design aspect in the agreement. It is not any "proprietary" system or component engineered by the manufacturer or pre-engineered via published information (example: standards). The engineering responsibilities and "performance" criteria is documented in the Contract Documents.
- B. Applicant: Person applying for building permit and person coordinating Contractor Engineered systems with basic building and with each other. Includes coordination of required submittals.
- C. Owner is not responsible to pay for any delays, additional products, additional hours of work or overtime, restocking or rework required due to failure by Contractor or Subcontractor to coordinate their work with work of other trades on project or to provide Delegated Design portion or component in a timely manner to meet project Schedule.
- D. Architect: Architect registered in the State in which the Project is located and engaged by Owner to provide contract documents including computations and specifications required by Building Official for principal project systems. Includes Architect's staff, consultants and consultants staffs.
 - 1. Architect's of Record's review of Delegated Design Engineered component submittals shall be for design intent and shall not lessen nor shift responsibility from Contractor or assigned subcontractor, to Owner nor Architect.
- E. Contractor: Firm engaged by Owner to construct Project. Includes employees, subcontractors and suppliers.
- F. Design Engineer: Professional Engineer registered in the State in which the Project is located and engaged by Contractor, subcontractor or supplier to provide drawings, computations and specifications required by Building Official for designated Contractor Engineered specialty system, in accordance with criteria set forth in Contract Documents.
- G. Seal for Delegated Design: Certification that drawings, computations and specifications were designed and prepared under direct supervision of Architect or Engineer whose name appears thereon.

- H. Delegated Design Component Review Stamp: Confirmation that design drawings has been reviewed for compatibility with design of the building.
- I. Approval Stamp: Certification that Building Official has reviewed submittal and finds it acceptable with respect to applicable code compliance.

1.03 REFERENCE STANDARDS

- A. Refer to references in Part 1, General, in each specification section with Delegated Design Work.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Delegated Design component submittals are required to contain:
 - 1. Complete criteria
 - 2. Design assumptions
 - 3. Details
 - 4. Calculations
 - 5. Structural elements, calculations and drawings to be stamped by Delegated Design Engineer registered in the State in which the Project is located.
 - 6. Instructions for fabrication, assembly, installation and interface with other trades.
- C. Submit Delegated Design SUMMARY sheet to jurisdiction having authority per AHJ requirements.

1.05 SUBMITTAL REQUIREMENTS

- A. Components are those subject to lateral or vertical loads and are not designed by Architect.
 - 1. These components require design by Contractor Design Engineer who received subcontract or purchase order for that component of Project.
- B. Components shall be coordinated with adjunct systems whether designed by Architect or are other Contractor components.
- C. Building Department Deferred Submittals: See drawings.
- D. Before work is allowed to proceed the following must occur:
 - 1. Submit complete legible documents.
 - 2. Documents must be examined and approved by Authority Having Jurisdiction (AHJ).
- E. Documents not completed prior to issuance of building permit, must be completed and submitted to Authority Having Jurisdiction for approval prior to fabrication.

1.06 QUALITY ASSURANCE

- A. Refer to quality assurance described in Part 1, General in specification sections with Delegated Design components.
- B. Perform design and prepare design 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.
- C. Quality assurance described in specification sections shall be minimum acceptable standards for this project.

- D. Should quality assurance not be defined within specific specifications, printed industry standards for "normal" quality practices shall govern.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Certain components of Project's construction are designated Delegated Design components. Contractor is responsible to coordinate and assume or assign to subcontractors and/or suppliers complete responsibility for design, calculations, submittals, permits if required, fabrication, delivery and installation of Delegated Design components.
- B. Contractor is responsible, with no exceptions, for submittal of Delegated Design components documents to Building Department for review, so review will not adversely affect Project's construction schedule.
 - 1. Delegated Design components are defined as complete systems provided for intended use.
- C. Architect's review of Delegated Design Engineered submittals is for general conformance with design intent.
 - 1. Architect not responsible for coordination of Delegated Design components with Contract Documents or review of materials submitted as result of Delegated Design components.
 - 2. Review does not lessen nor shift burden of responsibility from Contractor or assigned subcontractor/ supplier to Owner or Architect.
- D. Owner not responsible to pay for delays, additional products, hours of work or overtime, restocking or rework required due to failure to coordinate work with other trades or to provide components in timely manner to meet Project Schedule.

2.02 DELEGATED DESIGN COMPONENTS: FOLLOWING ARE DELEGATED DESIGN COMPONENTS KNOWN AT THIS TIME TO REQUIRE REVIEW AND SUBMITTAL:

- A. Section 05 40 00 - Cold-Formed Metal Framing: system and attachments for wind, seismic and dead loads.
- B. Section 05 40 10 - Cold-Formed Furring Assemblies: system and attachments for wind, seismic and dead loads.
- C. Section 05 50 00 - Metal Fabrications: custom ladders, casework supports, bollards.
- D. Section 05 52 13 - Pipe and Tube Railings: attachments, tube thickness, connections within system.
- E. Section 07 42 13 - Metal Wall Panels: attachments beyond manufacturers standards, gauge above minimum.
- F. Section 08 43 13 - Aluminum-Framed Storefronts.
- G. Section 09 21 16 - Gypsum Board Assemblies: interior studs with non-typical heavy loading
- H. Section 09 51 00 - Acoustical Ceilings: attachments beyond manufacturers and jurisdiction standards.
- I. Division 21 - Fire-Suppression Sprinkler Systems. system design, attachments and supports (including acoustic and seismic isolation).

- J. Division 22 - Plumbing Systems: system design, attachments and supports (including acoustic and seismic isolation).
- K. Division 23 - Mechanical Systems: system design, attachments and supports (including acoustic and seismic isolation).
- L. Division 26 - Electrical Systems: system design, attachments and supports (including acoustic and seismic isolation).
- M. Division 28 - Fire Detection and Alarm: system design, attachments and supports (including acoustic and seismic isolation).

2.03 DESCRIPTIONS FOR SYSTEMS LISTED IN PROJECT MANUAL

- A. Refer to systems descriptions in Part 1, General and Part 2, Products in each technical specification section listed for references to Delegated Design components.

2.04 SPECIFIC REQUIREMENTS

- A. Delegated Design Components shown in contract Documents are shown for design intent.
- B. Intent is to have Delegated Design Entity responsible to design, provide, coordinate and install Delegated Design Component.
- C. Delegated Design Components are to include products specified.
- D. Delegated Design Components attached to structural frame or supplemental to structural frame to be designed for anticipated loads outlined on structural drawings or found in Building Code for the state in which project is located.
- E. Coordinate Delegated Design Components with appropriate subcontractors.
- F. Load reactions at interface between Delegated Design Components and structural frame to be clearly defined to allow for a review by Engineer of Record.

PART 3 EXECUTION NOT USED

DELEGATED DESIGN SUMMARY SHEET

CONTRACTOR INFORMATION SHEET ___ OF ___

5.01 NAME: _____ **POSITION:** _____

5.02 PHONE: _____ **FAX** _____

5.03 MAILING ADDRESS: _____

PROJECT INFORMATION

6.01 STREET ADDRESS _____

6.02 DESCRIPTION OF WORK _____

PLAN CHECK INFORMATION

7.01 TYPE OF CHECK: _____

7.02 PLANS EXAMINER: _____ **DATE** _____

	DELEGATED DESIGN ITEM	A. SUPPLIER B. ENGINEER WHO WILL STAMP PLANS AND CALCULATIONS C. ENGINEER'S TELEPHONE NUMBER	A. DATE OF SUBMITTAL TO CITY B. SHEET#	REMARKS
1.				
2.				
3.				
4.				
5.				

END OF SECTION

**SECTION 01 40 00
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality Control Coordinator.
- C. Quality Control Requirements.
- D. Testing and inspection agencies and services.
- E. Mock-ups.
- F. Tolerances.
- G. Manufacturers' field services.
- H. Defect Assessment.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Quality Control Plan:
 - 1. Preconstruction Meeting: Submit for approval a written Contractor Quality Control (CQC) plan prior to meeting.
 - a. Plan to be used for agenda.
 - 2. Contractor shall submit for approval a revised written plan within 14 days after pre-installation meeting.
 - 3. Changes to plan during contract period as necessary to obtain quality specified to be through agreement between Architect, Owner and Contractor.
 - 4. No change in approved plan may be made without written concurrence by Contractor, Owner and Architect.
 - 5. Include following:
 - a. List of personnel responsible for quality control and assigned duties. Include each person's qualifications.
 - b. Copy of a letter of direction to Contractor's Quality Control Supervisor outlining assigned duties.
 - c. Methods of performing, documenting, and enforcing quality control of work.
 - 6. Contractor's Quality Control Daily Reports: Submit inspections and tests on first workday following date covered by report.
 - 7. Test Reports (Owners Testing Lab):
 - a. Submit Daily Test Information Sheets with Quality Control Daily Reports.
 - b. Submit failing test results and proposed remedial actions within four hours of noted deficiency.
 - c. Submit three copies of complete test results not later than three calendar days after test was performed.
 - 8. Off-Site Inspection Reports: Submit prior to shipment.

- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
- E. Certificates: When specified in individual specification sections, submit certification by manufacturer and Architect or installation/application subcontractor to Architect, in quantities specified for Product Data.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- H. Shop Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.

1.03 QUALITY ASSURANCE

- A. General:
 - 1. Quality of work: Contractor's responsibility.
 - 2. Testing: Responsibility of an Owner's independent testing laboratory
 - 3. Inspect and test Work often enough to ensure that quality of materials, workmanship, construction, finish, and functional performance is in compliance with applicable specifications and drawings.
 - 4. Quality Control Daily Reports shall be completed by Quality Control Supervisor.
 - 5. Test reports shall be completed by person performing test.
 - 6. Architect may designate locations of tests.
- B. Quality Control Coordinator:
 - 1. Contractor's Quality Control Coordinator shall be assigned no other duties.

- a. Coordinator shall responsible for work coordination of Building Envelope.
2. Contractor's jobsite supervisory staff may be used to assist the Quality Control Contractor, supplemented as necessary by additional personal.
3. Contractor's designated Quality Control Coordinator or competent supplementary personal shall be on the project site whenever contract work is in progress.

1.04 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.
- B. 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 ON-SITE -QUALITY CONTROL REQUIREMENTS

- A. Notification:
 1. Notify Architect at least 48 hours in advance of preparatory phase meeting.
 2. Notify Architect at least 24 hours in advance of the initial and follow-up phases.
- B. Preparatory Phase: Perform before beginning each feature of work.
 1. Review submittal requirements with personnel directly responsible for the quality control work. As a minimum, Contractor's Quality Control Supervisor and foreman responsible for the feature of work shall be in attendance.
 2. Review applicable specifications sections and drawings related to feature of work.
 3. Ensure that copies of referenced standards related to sampling, testing, and execution for feature of work are available on site.
 4. Ensure that provisions have been made for field control testing.
 5. Examine work area to ensure that preliminary work has been completed.
 6. Verify field dimensions and advise the Architect of discrepancies with contract documents.
 7. Ensure that necessary equipment and materials are at project site and that they comply with approved shop drawings and submittals.
 8. Prepare a report on preparatory phase activities and discussions. Attach report to Contractor's Quality Control Daily Report.
- C. Initial Phase:
 1. As soon as work begins, inspect and test a representative portion of a particular feature of work for quality of workmanship.
 2. Review control testing procedures to ensure compliance with contract requirements.
 3. Prepare a report on initial phase activities and discussions. Attach report to Contractor's Quality Control Daily Report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- D. Follow-Up Phase: Inspect and test as work progresses to ensure compliance with contract requirements until completion of work.
- E. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be required on same feature of work for following reasons:

1. Quality of on-going work is unacceptable.
2. Changes occur in applicable quality control staff, on-site production supervision, or work crew.
3. Work on a particular feature of work is resumed after a substantial period of inactivity.

3.02 MOCK-UPS

- A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- D. 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 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.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 2. Perform specified sampling and testing of products in accordance with specified standards.
 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 5. Perform additional tests and inspections required by Architect.
 6. The approved testing agency shall select samples of materials to be tested at random; the contractor shall not select the samples.
 7. Submit reports of all tests/inspections specified.
- C. 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.
- D. 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. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.
- G. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.
1. If second test conforms to specifications, then Owner will pay for cost of second test.

3.05 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 10 days in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

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

END OF SECTION

SECTION 01 40 10
AIR BARRIER SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Administrative and procedural requirements for accomplishing an airtight building enclosure that controls infiltration or exfiltration of air.
 - 1. Airtight components of the building enclosure and the joints, junctures and transitions between materials, products, and assemblies forming the air-tightness of the building enclosure are called "air barrier system".
 - a. Services include coordination between the trades, the proper scheduling and sequencing of the work, preconstruction meetings, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities.
 - b. They do not include contract enforcement activities performed by Architect, Contractor, Owner, or Building Enclosure Consultant.
 - 2. Project to meet Thermal Bypass Checklist requirements
 - a. Thermal Insulation must meet ANSI/RESNET/ICC 380, Grade I standard of quality installation; it must not be covered (e.g. by dry-wall) until verified and approved by an Earth Advantage third-party inspector.
 - 3. Contractor shall ensure that the intent of constructing building enclosure with a continuous air barrier system to control air leakage into, or out of conditioned space is achieved.
 - 4. Air barrier system shall have following characteristics:
 - a. It must be continuous, with all joints sealed.
 - b. It must be structurally supported to withstand positive and negative air pressures applied to building enclosure.
 - c. Connection shall be made between:
 - 1) Foundation and walls.
 - 2) Walls and windows or doors.
 - 3) Different wall systems.
 - 4) Demising walls of unit to unit and corridors.
 - 5) Fire-rated and non fire-rated top-plates on the top floor.
 - 6) Wall and roof.
 - 7) Wall and roof over unconditioned space.
 - 8) Walls, floor and roof across construction, control and expansion joints.
 - 9) Walls, floors and roof to utility, pipe and duct penetrations.
 - 10) Walls, floor and roof separating conditioned space from un-conditioned space.
 - d. Air Barrier Penetrations: Penetrations of air barrier and paths of air infiltration or exfiltration shall be made air-tight.
- B. Inspection and testing services may be required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

- C. Requirements of this section relate to the coordination between subcontractors to provide an airtight building enclosure, customized fabrication and installation procedures; it does not apply to production of standard products.
 - 1. Continuity of the air barrier materials and products with joints to provide assemblies.
 - 2. Continuity of all the enclosure assemblies with joints and transition materials to provide a whole building air barrier system.
 - 3. Specified inspections, tests and related actions do not limit Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
 - 4. Requirements for Contractor to provide an airtight building enclosure are not limited by quality assurance services rendered by the Architect, Owner, Building Enclosure Consultant, or authorities having jurisdiction and are not limited by provisions of this section.
- D. Drawings and general provisions of the Contract, Division 00 including General Conditions and supplementary Conditions and Division 01 Specification Sections, apply to this section.
- E. Related Requirements that apply to this section:
 - 1. Section 03 30 00 - Cast in Place Concrete
 - 2. Section 06 10 00 - Rough Carpentry
 - 3. Section 06 16 53 - Moisture Resistant Gypsum Board
 - 4. Section 07 21 19 - Foamed-in-Place Insulation
 - 5. Section 07 25 05 - Building Wrap Weather Barriers
 - 6. Section 07 25 11 - Self-Adhered Membrane Flashings
 - 7. Section 07 62 00 - Sheet Metal Flashing and Trim
 - 8. Section 07 92 00 - Joint Sealants
 - 9. Section 08 11 13 - Hollow Metal Doors and Frames
 - 10. Section 08 43 13 - Aluminum Framed Storefronts
 - 11. Section 08 53 13 - Vinyl Windows

1.02 REFERENCE STANDARDS

- A. ANSI/RESNET/ICC 380 - Standard for Testing Airtightness of Building, Dwelling Unit, and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems; and Airflow of Mechanical Ventilation Systems 2019.
- B. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization 2019.
- C. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).
- D. ASTM E1677 - Standard Specification for Air Barrier (AB) Material or Assemblies for Low-Rise Framed Building Walls 2019.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

1.03 QUALITY ASSURANCE

- A. Specific quality-control requirements for individual construction activities are specified in the sections of the specifications.

- B. Specific quality-control requirements for individual construction activities are specified in Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide coordination of the trades, and the sequence of construction to ensure continuity of the air barrier system joints, junctures and transitions between materials, and assemblies of materials and products, from substructure, to walls, to roof and coordinate with sequence of installation with required quality assurance testing described herein.
- C. Provide quality assurance procedures, testing and verification as specified herein. Facilitate inspections, tests and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction or by the Owner. Costs for these services are included in the Contract Sum.
 - 1. Organize preconstruction meetings between the trades involved in the whole building's air barrier system to discuss where each trade begins and ends and the responsibility and sequence of installation of all the air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in the different sections, to be installed by the different trades.
 - 2. Building a mock-up before proceeding with the work, satisfactory to the Architect, of each air-tight joint type, juncture, and transition between products, materials and assemblies.
 - 3. Test Building Mock-up as outlined in Section 01 43 39.
- D. Associated Services: Cooperate with personnel performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
 - 1. Provide access to the work.
 - 2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 - 3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 - 4. Deliver samples to testing laboratories.
 - 5. Provide security and protection of samples and test equipment at the project site.
- E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
 - 1. Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
 - 2. Earth Advantage's role involves guidance in certification standard requirements, field verification and performance testing associated with pre-requisite and elective measures as outlined in the Earth Advantage Multifamily Certification Points worksheet and corresponding reference guide.

1.04 DEFINITION

- A. Air Barrier: Defined as a system of materials designed and constructed to control airflow between a conditioned space and a less conditioned space.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Submit certified written reports, in duplicate, of each inspection, test, or similar service.
 - 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 - 2. Testing agency shall be responsible for submitting written reports of each inspection, test, or similar service.
- C. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
 - 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 the inspection or test.
 - 6. Work designation and test method
 - 7. Identification of product and Specification Section.
 - 8. Complete inspection or test data.
 - 9. Test results and an interpretation of test results.
 - 10. Ambient conditions at the time of sample taking and testing.
 - 11. Comments or professional opinion on whether inspected or tested work complies with Contract Documents.
 - 12. Name and signature of inspector.
 - 13. Recommendations on re-testing.

PART 2 PRODUCTS

2.01 MATERIALS

- A. As noted above in Related Requirements. Materials specified make up the air barrier system of the building to be inspected and tested.

2.02 PERFORMANCE REQUIREMENTS

- A. Materials:
 - 1. Air barrier system materials in the opaque envelope shall have an air permeance not to exceed 0.004 cfm/ft² under pressure differential of 0.3 in. water (1.57psf) (0.0002 L/S*m² @ 75 Pa) when tested in accordance with ASTM E2178.
- B. Assemblies of Materials and Components:
 - 1. Air permeance not to exceed 0.04 cfm/ft² under a pressure differential of 0.3 in. water (1.57psf) (0.002L/S*.m² @ 75 Pa) when tested in accordance with ASTM E1677 or ASTM E783.
- C. Unit Compartmentalization Testing:
 - 1. Unit Compartmentalization test must be performed.
 - 2. If test results exceed 0.30 CFM50, (50 pascals of pressure or approximately 0.2 inches w.g.) per SF of enclosure in accordance with ANSI/RESNET/ICC 380 and Earth Advantage's certification protocols, then visually inspect unit compartmentalization barrier and seal noted sources of leakage.

3. Failed unit(s) will be retested along with additional units in the sampling set for compliance.
 4. Corrective measures taken to be provided to certification body for review/acceptance.
- D. Air tightness Goal of Shell Building:
1. Air leakage of the entire building shall not exceed 0.40 cfm/sf under a pressure differential of 0.3 in. water (1.57psf)(0.02L/S*m² @ 75 Pa) when tested according to ASTM E779 following the multi-point test protocol outlined in the Building Code and Army Corps of Engineers Whole Building Air Leakage Test Protocol.
 2. Where conflicts exist, the Building Code requirements take precedence.

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

- A. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with contract document and Section 01 73 29 for Cutting and Patching.
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

3.02 FIELD QUALITY CONTROL

- A. Owner will hire a Testing and Inspection Agency to provide periodic observation and inspection during installation of the air barrier system.
 1. Provide report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the building Owner and Code Official. If the tested rate exceeds that defined here by up to 0.15 cfm/sq ft, a visual inspection of the air barrier shall be conducted and any leaks noted shall be sealed to the extent practicable. An additional report identifying the corrective actions taken to seal air leaks shall be submitted to the building Owner and Code Official, and any further requirement to meet the leakage air rate will be waived. If the tested rate is between 0.25 and 0.40 cfm/sq ft, corrective actions must be made and the test completed again. Test above 0.40 cf./sq ft will not be accepted.
 - a. Test shall be accomplished using either (1) both pressurization and depressurization, or (2) pressurizations alone, but not depressurization along. The test results shall be plotted against the correct P for pressurization in accordance with Section 9.4 of ASTM E779.
 - b. Test pressure range shall be from 25 Pa to 80 Pa per Section 8.10 of ASTM E779, but the upper limit shall not be less than 50 Pa, and the difference between the upper and lower limit shall not be less than 25 Pa.
 - c. If the pressure exponent n is less than 0.45 or greater than 0.85 per Section 9.6.4 of ASTM E779, the test shall be rerun with additional readings over a longer time interval.
- B. Testing and Inspection Agency will review a representative sample of air barrier components/systems, including, but not limited to the following:

1. Continuity of the air barrier system.
2. Structural support of the air barrier system.
3. Site conditions for application temperature and dryness of substrates.
4. Maximum length of exposure time of materials.
5. Surfaces are properly prepared, primed, etc.
6. Laps in material are appropriate, shingled in the correct direction, with no fish mouths or wrinkles.
7. Mastic applied on cut edges of self adhered membranes as required.
8. Roller has been used to promote adhesion.
9. Measurements of the thickness of liquid-applied materials to manufacturer's specifications for the specific substrate.
10. Connections between assemblies and materials (membrane and sealants) for proper substrate preparation, support, integrity, and continuity.
11. Penetrations sealed to air barrier component.

3.03 SHELL BUILDING AIR LEAKAGE TESTING

- A. Owner is to engage a qualified testing agency to perform a whole building air leakage test at substantial completion of the building air barrier system.
 1. Building Test: The completed building shall be tested and the air leakage rate of the building envelope shall not exceed 0.25 cfm/sq ft, at a pressure differential of 0.3 inches water gauge (2.0 L/s x sq m at 75 Pa) at the upper 95 percent confidence interval in accordance with ASTM E779 or an equivalent method approved by the Code Official. A report that include the test surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the building Owner, and the Code Official. If the tested rate exceeds the defined here by up to 0.15 cfm/sq ft, a visual inspection of the air barrier shall be conducted and any leaks noted shall be sealed to the extent practicable. An additional report identifying the corrective actions taken to seal air leaks shall be submitted to the building Owner and the Code Official, and any further requirement to meet the leakage air rate will be waived. If the tested rate is between 0.25 and 0.40 cfm/sq ft, corrective actions must be made and the test completed again. A test above 0.40 cfm/sq ft, will not be accepted.
 - a. Test shall be accomplished using either (1) both pressurization and depressurization, or (2) pressurizations alone, but not depressurization along. The test results shall be plotted against the correct P for pressurization in accordance with Section 9.4 of ASTM E779.
 - b. The test pressure range shall be from 25 Pa to 80 Pa per Section 8.10 of ASTM E779, but the upper limit shall not be less than 50 Pa, and the difference between the upper and lower limit shall not be less than 25 Pa.
 - c. If the pressure exponent n is less than 0.45 or greater than 0.85 per Section 9.6.4 of ASTM E779, the test shall be rerun with additional readings over a longer time interval.
- B. Approximately 3 tests - minimum 1 test per residential building and one per commercial space.
- C. Test Preparation:
 1. Two weeks in advance of testing, Contractor shall coordinate a pre-testing walkthrough with the testing agency and HVAC sub-contractor to discuss pre-test preparation required

- by the Contractor. Contractor shall familiarize themselves with the Army Corps of Engineers Whole Building Air Leakage Test Protocol and pre-testing preparation.
2. Two days prior to testing, Contractor shall have all temporary enclosures in place for testing agency review and pre-testing to confirm all extraneous air leakage paths are sufficiently sealed off. Contractor shall undertake any re-sealing/modifications of temporary enclosures to the testing agencies satisfaction.
 3. Contractor to provide temporary enclosures to seal all intentional functional openings such as exhaust and relief louvers, grilles, cooktop vents, dryer vents and garbage chutes that are not used in the test to introduce air, using plastic sheeting and duct tape or similar materials.
 4. Contractor must prop open all doors (bounded in part by and exterior wall, roof or floor included within the test area) for the duration of the test.
 5. All plumbing traps shall be filled with water.
 6. During scheduled testing, Contractor shall provide the testing agency complete, uninterrupted access to entire building for duration of test.
 7. During testing, Contractor shall coordinate with the fire department to have the fire alarm set in test mode.
 8. During testing, all HVAC systems shall be powered down for duration of test.
 9. Contractor shall control access during testing to prevent any unauthorized entrance/exit to the building.

3.04 UNITIZED COMPARTMENTALIZATION TESTING

- A. Owner is to engage a qualified Testing Agency to perform compartmentalization test at substantial completion of the unit air barrier system.
- B. Testing and reporting to be in compliance with following:
 1. Requirements in those sections may also cover production of standard products.
 2. It is Contractor's responsibility to ensure that each subcontractor is adequately and satisfactorily performing the quality assurance documentation, tests and procedures required by each section.

END OF SECTION

SECTION 01 42 16
DEFINITIONS AND REFERENCE STANDARDS

PART 1 GENERAL

1.01 SUMMARY

- A. Section supplements the definitions contained in the General Conditions.
- B. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

- A. Approved:
 - 1. When used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in Conditions of Contract.
- B. Building Code: 2019 Oregon Structural Specialty Code.
- C. Directed:
 - 1. Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.
- D. Furnish:
 - 1. Means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- E. Indicated:
 - 1. Refers to graphic representations, notes, or schedules in Drawings; or to other paragraphs or schedules in Specifications and similar requirements in Contract Documents.
 - 2. Terms such as "shown," "noted," "scheduled," and "specified" are used to help user locate reference. Location is not limited.
- F. Install:
 - 1. Describes operations at Project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- G. Installer:
 - 1. Contractor or another entity engaged by Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations.
 - 2. Installers are required to be experienced in operations they are engaged to perform.
 - 3. Term "experienced" when used with term "installer" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- H. Owner: Means owner of project or his agent when applicable.
- I. Product:
 - 1. Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection

- and not incorporated into the work result.
2. Products may be new, never before used, or re-used materials or equipment.
- J. Project Manual:
1. Book-sized volume that includes procurement requirements (if any), contracting requirements, and specifications.
- K. Project site:
1. Space available to Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project.
- L. Provide:
1. Means to furnish and install, complete and ready for intended use.
- M. Regulations:
1. Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within construction industry that control performance of Work.
- N. Testing Agencies:
1. Independent entities engaged to perform specific inspections or tests, either at Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.03 PROJECT MANUAL

- A. Divisions in Project Manual conform roughly to customary trade practice.
1. This is done for convenience and shall not relieve Contractor of responsibility of furnishing every item indicated or specified whether properly segregated or not.
- B. No responsibility will be assumed by Owner or Architect for omission or duplications by Contractor in completion of contract due to arrangement of material in Project Manual.

1.04 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. Conform to reference standard of date of issue specified in the individual specification sections, except where a specific date is established by applicable code.
- C. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

1.05 REFERENCES AND STANDARDS

- A. Minimum Quantity or Quality Levels: Quantity or quality level shown or specified shall be minimum provided or performed.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

1.06 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

- A. In event of conflict or discrepancy among the Contract Documents, interpretations will be based on the following priorities:
 - 1. Agreement.
 - 2. Addenda, with those of later date having precedence over those of earlier date.
 - 3. Supplementary Conditions.
 - 4. General Conditions of the Contracts.
 - 5. Schedules.
 - 6. Drawings and Specifications:
 - a. In the case of inconsistency between Drawings and Specifications or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.
 - b. Large Scale Drawings.
 - c. Small Scale Drawings.
 - 7. Dimension numbers written on Drawings prevail and take precedence over Dimensions scaled from Drawings.

1.07 SPECIFICATION FORMAT AND CONTENT EXPLANATION (MF04)

- A. Divisions in Project Manual conform CSI MasterFormat 2004 and roughly to customary trade Work Results.
- B. MasterFormat 2004 edition numbering revision explained:
 - 1. One of the most significant changes in the MasterFormat 2004 Edition is the adoption of a six-digit numbering system in place of the familiar five-digit system that has been used in MasterFormat since the 1978 edition.
 - 2. MasterFormat 2004 six-digit numbering system provides exponentially more expansion spaces per level than the five-digit system, all but eliminating concerns about future expansion.
- C. MasterFormat 2004 Section Format is as follows:
 - 1. MasterFormat 2004 has adopted a six-digit numbering system in place of the familiar five-digit system that has been used in MasterFormat since the 1978 edition.
 - 2. Section Format numbering system of 11 22 33 is used in this specification. Other Section Format numbering systems that maybe used by consultants are 11 2233 or 112233. In all cases the numbering system shall be deemed the same and interchangeable within the Project Manual.
 - 3. MasterFormat Divisions have been increase from 16 Divisions to 50 Divisions, with Divisions 00, 01 and 03-14 basically the same and the following revised:
 - a. Division 02 – Existing Conditions:
 - 1) This division is now limited to "existing conditions," construction practices that relate to items at the site at the commencement of work – selective demolition, subsurface and other investigation, surveying, site decontamination, and site remediation, among others.
 - 2) Material has been relocated to Divisions 30-39 in the Site and Infrastructure Subgroup. All site construction as well as heavy civil and infrastructure subject matter, including utility and pavement work are included in this Subgroup.

- b. Division 15 – Mechanical:
 - 1) Division 15 has been reserved for future expansion
 - 2) Material has been relocated to Division 22 – Plumbing and Division 23 – Heating, Ventilating, and Air Conditioning in the Facility Services Subgroup, Divisions 20-29.
- c. Division 16 - Electrical:
 - 1) Division 16 has been reserved for future expansion
 - 2) Material has been relocated to Division 26 – Electrical and Division 27 – Communications in the Facility Services Subgroup Divisions 20-29.
- d. For additional information on MasterFormat 2004 see www.csinet.org/masterformat.
- D. MasterFormat 2004 numbering system use is encouraged for all parties. If using previous version of MasterFormat in submittals or application for payment, then use the following format:
 - 1. 00 11 22(01122), where the MasterFormat 2004 number is used first, followed by the old five-digit MasterFormat-95 number in parentheses.
- E. Project Manual is done for convenience and shall not relieve Contractor of responsibility of furnishing every item indicated or specified whether segregated or not.
- F. No responsibility will be assumed by Owner or Architect for omission or duplications by Contractor in completion of contract due to arrangement of material in Project Manual.
- G. Specification Content:
 - 1. Abbreviated Language:
 - a. Language used in Specifications and other Contract Documents is abbreviated.
 - b. Words and meanings shall be interpreted as appropriate.
 - c. Words implied, but not stated, shall be interpolated as sense requires.
 - d. Singular words shall be interpreted as plural, and plural words as singular, where applicable as context indicates.
 - 2. Imperative mood and streamlined language are generally used in Specifications.
 - a. Requirements expressed in imperative mood are to be preformed by Contractor.
 - b. Subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by Contractor, or by others when so noted.
 - c. Words "shall," "shall be," or "shall comply with," depending on context, are implied where a colon (:) is used within a sentence or phrase.

END OF SECTION

SECTION 01 43 39
FREE STANDING BUILDING MOCKUP

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building mockup as indicated in Drawings built on-site.
- B. Unit mockup.

1.02 REFERENCE STANDARDS

- A. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015 (Reapproved 2023).
- B. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Submit shop drawings for fabrication and installation two week prior to construction of Building Mock-up.
 - 2. Provide the following:
 - a. Site location drawing, showing Building Mockup on-site, access roads, north arrow, and drawing scale.
 - b. Floor Plan: 1/2-inch scale.
 - c. Wall Elevations: 1/4-inch scale.
 - d. Wall sections: 3/4-inch scale.
 - e. Half-size details of conditions for every member, joint, anchorage, weld size, glazing system, wall panel system, and provision for expansion and contraction and sealant application.
 - f. Isometric details to completely describe items being proposed by subcontractor involved, or as requested by Architect.
 - g. Coordination details for related and adjoining Work, insert templates, and erection diagrams to completely describe and construct Building Mockup.
 - 3. Glazing Sections:
 - a. Show dimensions, including but not limited to, section thicknesses, frame lap over glass, and edge clearance.
 - b. Show tolerances for dimensions including but not limited to field dimensions, mill and shop dimensions, and glass dimensions.
 - 4. Wall Panel Sections:
 - a. Show dimensions, including but not limited to, section thicknesses and edge clearance.

- b. Show tolerances for dimensions including but not limited to field dimensions, mill and shop dimensions, and panel dimensions.
 5. Enclosures and accommodations for test equipment:
 - a. Comply with ASTM E1105.
 - b. Show calculations ensuring enclosures are designed to withstand pressures and test conditions of testing.
- C. Structural Calculations sealed and signed by the Professional Engineer responsible for their preparation and registered in State where Project is located.
 1. Show ultimate factor of safety.
 2. Prepare calculations in accordance with more stringent of current design rules of Aluminum Association, AISC, AISI, ACI, or these Project Specifications.

1.04 QUALITY ASSURANCE

- A. Comply with technical specification Section for each material included in Building Mockup, and for administration and coordination requirements specified.
- B. Personnel constructing mockup assemblies shall be same as working on project.
- C. Make a video record of assembly methods used for construction of Building Building Mockup. Comply with Section 01 30 00 Submittal Procedures.
- D. Defective materials and workmanship include, but are not limited to, evidence of:
 1. Penetration of water into or through mockup.
 2. Air infiltration exceeding specified limits.
 3. Delamination of wall insulated glass units.
 4. Cracking, crazing, flaking of coatings and opacifiers on glass.
 5. Discoloration or fading, excessive non-uniformity, pitting, cracking, peeling, crazing, or corrosion of finishes.
 6. Glass breakage.
 7. Secondary glass damage and/or damage due to failing building skin components.
 8. Warping, racking, or movement out of plane of metal or metal composite wall panels.
 9. Shearing, popping, or movement of fasteners, concealed or exposed.
 10. Warping, racking, or movement out of plane of window frames.
 11. Operable window units that bind, stick, or do not operate smoothly.
 12. Adhesive or cohesive failure of sealants.
 13. Crazing on surface of sealants.
 14. Sealant hardening beyond Shore A durometer 50 or softening below 20.
 15. Chipping or spalling of concrete.

1.05 FIELD CONDITIONS

- A. Environmental Conditions: Do not proceed with Building Mockup construction when ambient temperature and substrate conditions are outside limits permitted by any of manufacturers of materials and systems included in the Building Mockup.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE REQUIREMENTS

- A. Purpose:
 - 1. Building Mockup is to demonstrate that materials and systems forming exterior shell of Project meet or exceed performance requirements specified as follows:
 - a. Design Wind Pressure: As indicated on Structural drawings.
 - b. Water Resistance Test Pressure: 9 psf.
- B. Materials and systems that fail to contribute to formation of a water and air-tight exterior shell, or that show excessive stress, weathering, discoloration, or other weakness, shall be re-evaluated for use in Project.
- C. Performance Criteria: ASTM E1105.ASTM E1105
 - 1. Air Leakage: ASTM E283.

2.02 PRODUCTS

- A. Follow requirements and products listed in PART 2 PRODUCTS within referenced specification Sections and systems indicated on drawings for mock-up assembly.

2.03 BUILDING MOCKUP ASSEMBLY

- A. Mock-up Size: As indicated on drawings.
- B. Exterior Wall Assembly
 - 1. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
 - a. See drawings for mockup design and components including the following: Precast concrete, brick, windows, flashings, water repellant and anti-graffiti repellant coatings.
 - b. Mock-up shall be located on site and constructed at the earliest possible time as coordinated with Coordinator.
 - 2. Accepted mock-ups shall be a comparison standard for the remaining Work.
 - 3. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so. Mock up to be removed upon completion of project.
- C. Location: As indicated on drawings for on-site construction.
- D. Mock-up may not remain as part of the Work.

PART 3 EXECUTION

3.01 GENERAL

- A. See Section 01 40 00 for additional requirements.

3.02 MOCKUP ERECTION REQUIREMENTS

- A. Complete mockup prior to installation of any systems on building.
- B. Construct mockup as indicated on drawings.

1. Duplicate conditions and methods proposed for final construction.
- C. Sequence installation to demonstrate that materials and systems forming exterior shell meet design intent.
- D. Complete all testing and retesting prior to installation of any systems within mockup on building.

3.03 TESTING

- A. Owner to engage qualified independent Testing Agency to perform testing of Building Mockup.
- B. Coordinate and schedule testing with Owner's engaged testing agency.
- C. Test installed windows for compliance with performance requirements for water penetration, in accordance with ASTM E1105 cyclic pressure and the same pressure difference as specified for laboratory testing.
- D. Water Penetration:
 1. Test installed systems at locations and to extent indicated by Architect.
 2. Perform minimum of one (1) water test by method specified in ASTM E1105.
 3. Testing to evaluate watertightness of intersections of systems as well as of each individual system.
 - a. Testing windows for water infiltration to be conducted with window manufacturer's representative present.
 4. Areas to include, but not limited to:
 - a. Fixed and operable windows.
 - b. Cladding systems.
 - c. Penetrations.
 5. Durations: Four (4) cycles of five (5) minutes each with one (1) minute of neutral pressure between cycles.
- E. Notify Architect and Owner, in writing, minimum of 14 days prior to conducting field testing.

3.04 REPAIR AND RETESTING

- A. Repair or remove Work that does not meet specified requirements, or that is damaged by testing.
 1. Where repair does not produce system(s) that meet specified performance requirements, replace system components with new components and re-test.
 2. Obtain Architect's acceptance of corrective Work prior to executing it.
- B. Costs of corrective Work and re-testing necessary to arrive at performance requirements are Contractor's responsibility.
 1. Re-testing includes testing fees, Architect fees, Consultant fees.
 2. Re-testing costs due to re-design by Architect will be paid by Owner.

3.05 REMOVAL

- A. Remove mock-up and clear area when directed or at projection completion.

END OF SECTION

**SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary sanitary facilities.
- C. Temporary Controls: Barriers, enclosures, and fencing.
- D. Vehicular access and parking.
- E. Waste removal facilities and services.
- F. Project identification sign.
- G. Field offices.

1.02 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.03 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police and fire department rules.
 - 5. Environmental protection regulations.
- B. Standards: Comply with following:
 - 1. NFPA 241.
- C. Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70.
- D. Inspections:
 - 1. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use.
 - 2. Obtain required certifications and permits.

1.04 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

- B. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to type of fuel being consumed.
- C. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces.
 - 1. In other locations, provide hand-carried, portable, UL-rated, Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA recommended classes for exposures.
- D. Temporary Fire Protection:
 - 1. Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses until permanent fire protection facilities are operable.
 - 2. Comply with NFPA 10 and NFPA 241.
 - 3. Store combustible materials in containers in fire safe locations.
 - 4. Maintain unobstructed access to fire protection equipment.
 - 5. Provide supervision of welding operation, combustion type temporary heating units, and similar sources of fire ignition.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Provide self-contained, single-occupant toilet units of chemical, aerated recirculation or combustion type.
 - 1. Provide units properly vented and fully enclosed with a fiber-glass-reinforced polyester shell or similar non-absorbent material.
- C. Wash Facilities:
 - 1. Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up.
 - 2. Dispose of drainage properly. Supply cleaning compounds.
 - 3. Provide safety showers, eyewash fountains and similar facilities for safety and sanitation of personnel.
- D. Drinking Water Facilities:
 - 1. Provide containerized tap-dispenser bottled-water type drinking water units.
- E. Maintain daily in clean and sanitary condition.
- F. At end of construction, return facilities to same or better condition as originally found.
- G. Rodent and Pest Control:
 - 1. Retain an exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests.
 - 2. Employ this service to perform extermination and control procedures at regular intervals so that Project will be free of pests and their residues at Substantial Completion.

1.06 LIFT AND HOISTS

- A. Temporary Lifts and Hoists:
 - 1. Provide facilities for hoisting materials and employees.

2. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
 3. Temporary Elevator Use: Refer to Division 14 Sections for elevators.
- B. Stairs:
1. Provide temporary stairs where ladders are not adequate until permanent stairs are available.
 2. Cover finished permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

1.07 FENCING

- A. Construction: Contractor's option.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.
1. Enclose entire site or portion determined sufficient to accommodate construction operations to prevent people, dogs, and other animals from easily entering site, except by entrance gates.

1.08 EXTERIOR ENCLOSURES

- A. Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior, including roof and exposed floors without roof covering.
1. Vertical Openings: Close openings with plywood or similar materials.
 2. Horizontal Openings and Surfaces: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 - a. Provide temporary weather protection, remove standing and ponding water as soon as possible to prevent water damage.
 3. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
 4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing at fire rated walls, otherwise use any temporary weather protection material.
- B. 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.

1.09 INTERIOR ENCLOSURES

- A. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.10 SECURITY

- A. Coordinate with Owner's security program.

1.11 VEHICULAR ACCESS AND PARKING

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Temporary Paving:
 - 1. Construct and maintain temporary roads and paving to accommodate traffic during construction period.
 - a. Locate where same permanent facilities will be located; review proposed modifications to permanent paving with Architect.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.12 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Prepare signs to provide directional information to construction personnel and visitors.
- C. No other signs are allowed without Owner permission except those required by law.

1.14 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Locate offices a minimum distance of 30 feet from existing and new structures.
- C. Storage and Fabrication Sheds:
 - 1. Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

1.16 PROJECT CONDITIONS

- A. Keep temporary services and facilities clean and neat in appearance.
- B. Operate in a safe and efficient manner.
- C. Relocate temporary services and facilities as Work progresses.
- D. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

1.17 TERMINATION AND REMOVAL

- A. Remove each temporary facility when need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion, unless otherwise requested by Owner or Architect.
- B. Materials and facilities that constitute temporary facilities are Contractor's property.
 - 1. Owner reserves right to take possession of Project identification signs.
- C. Remove temporary paving not intended for or acceptable for integration into permanent paving.
 - 1. Where temporary paving has occurred in areas intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill of subsoil in area.
 - a. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawn.
 - 2. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by governing authority.
- D. Substantial Completion: Clean and renovate permanent facilities used during construction period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 50 50**EROSION CONTROL****PART 1 - GENERAL****1.01 SCOPE OF WORK**

- A. The Contractor shall provide all materials, labor and equipment necessary to complete all work as specified herein, including but not limited to the following:
 - 1. Apply specified treatments to all cuts and fill slopes, soil stockpiles, and all disturbed areas.
 - 2. Install all temporary erosion control devices per Plans and Specifications.
- B. All other labor and materials reasonably incidental to the satisfactory completion of the work, including cleanup of the site.

1.02 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements

1.03 RELATED DOCUMENTS

- A. ODOT Standard Specifications and Erosion Control Manual, current edition
- B. Oregon DEQ permit requirements

1.04 QUALITY ASSURANCE

- A. All measures indicated in this specification may not be required. Contractor responsible for implementing erosion and sediment controls adequate to comply with permit requirements.
- B. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of specified products.
- C. Installers Qualifications: Firm with not less than 5 years of experience in installation of systems similar in complexity to those required for this project.
- D. Regulatory Requirements:
 - 1. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained.
 - 2. An erosion control permit is required from the City of Beaverton and DEQ. The Owner shall apply, pay for, and secure the permit. The contractor shall comply with the construction erosion control permit.
 - 3. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.

4. Action Plan: Contractor shall prepare and submit an Action Plan when Erosion and Sediment Control Measures are modified after permit registration is approved. The Action Plan shall identify revisions made to the approved Erosion and Sediment Control Plan, and shall identify corrective actions taken to cease the discharge of sediment into surface waters or stormwater systems. The Action Plan shall be prepared in accordance with the 1200-C Construction Stormwater Permit Registration Guidance document published by Oregon DEQ in June 2006. An Action Plan shall be required under the following circumstances:
 - a. Emergency Situations: Emergency change in erosion control measures due to emergency situations, where immediate corrective action is required to cease the discharge of significant amounts of sediment from entering surface waters or nearby properties. In emergency situations, contractor shall take immediate action to correct the stormwater discharge. Contractor shall submit action plan to Engineer [DEQ] within __ [10] calendar days of the discharge identifying the corrective actions taken to cease the discharge.
 - b. Non-Emergency Changes Made Once Project is Underway: Submit Action Plan for changes in the project design affecting stormwater discharges, local conditions, project schedule, weather conditions, or other appropriate reasons. Action Plan shall be required for changes to the Erosion and Sediment Control Measures identified in the Drawings, their location, maintenance required, and any other revisions necessary to prevent and control erosion and sediment runoff. Contractor shall submit action plan to Engineer [DEQ] at least __ [10] calendar days before implementing the revisions.
 5. Comply with current edition of Oregon Standard Specifications for Construction published by ODOT.
- E. Stormwater Runoff: Control increased stormwater runoff due to disturbance of surface cover due to construction activities for this project.
1. Prevent runoff into storm sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
1. Control movement of sediment and soil from temporary stockpiles of soil.
 2. Prevent development of ruts due to equipment and vehicular traffic.
 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
1. Prevent windblown soil from leaving the project site.
 2. Prevent tracking of mud onto public roads outside site.
 3. Prevent mud and sediment from flowing onto sidewalks and pavements.

4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways and storm sewers.
 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments and relocate on site; comply with requirements of authorities having jurisdiction.
- I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments and relocate on site; comply with requirements of authorities having jurisdiction.
- J. Open Water: Prevent standing water that could become stagnant.
- K. Monitoring and Inspection:
 1. Contractor shall be responsible for monitoring the construction erosion control measures and shall make adjustments to measures, in accordance with the drawings and permit, to accommodate changes in earthwork operations and weather conditions.
 2. Contractor shall be responsible for appointing an Erosion Control Inspector. Inspector shall be a person knowledgeable in the principles and practice of erosion and sediment controls, who possesses the skills to assess conditions at the construction site that could impact stormwater quality, is knowledgeable in the correct installation of the erosion and sediment controls, and is able to assess the effectiveness of any sediment and erosion control measures selected to control the quality of stormwater discharges from the construction activity. If required by DEQ or local jurisdiction, Erosion Control Inspector shall have current applicable certifications. Erosion Control Inspector shall submit periodic inspection reports as noted on the Drawings.

1.05 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit, in accordance with Section 01 10 00, Supplemental General Requirements, manufacturer's letters of compliance and manufacturer's literature for the following items:
 1. Seed Mixes (or individual items)
 2. Mulches
 3. Binders/Tackifiers
 4. Fertilizer
 5. Humate
 6. Soil inoculates
 7. Straw (Weight receipts from scales shall be required)
 8. Erosion Control Blanket

9. Inlet Protection Products

1.06 SITE CONDITION

- A. It is the responsibility of the Contractor to visit the site to determine existing conditions including access to the site, the nature and extent of existing improvements upon adjacent public and private property, the nature of materials to be encountered, and other factors that may affect the work of this section.
- B. It is the responsibility of the Contractor to have finished the grading of the slopes, including track walking the areas to be treated with erosion control treatments.

1.07 WORK SCHEDULE

- A. The Contractor shall proceed with work during a period of August 15 through October 15, 2XXX or between January 15 and February 15, 2XXX *[enter work period]*. The work shall progress as soon as the site becomes available consistent with normal seasonal limitations.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All products shall be delivered to the site in manufacturer's unopened standard containers bearing original labels showing quantity, analysis and name of manufacturer.
- B. All materials shall be stored in designated areas and in such a manner as to protect them from weather or other conditions that might damage or impair the effectiveness of the product.

1.09 ANALYSIS OF SAMPLES AND TESTS

- A. Samples: The Owner reserves the right to take and analyze samples of materials for conformity to the Specifications at any time. On request, seed shall delivered to Owner' Representative 30 days prior to seeding so seed can be tested. Seed samples shall be drawn in accordance with procedures outlined ODOT's Erosion Control Manual.
- B. Rejected material: Rejected materials shall be removed immediately from the site at Contractor's expense. Contractor shall pay the cost of testing replacement materials.

PART 2 - PRODUCTS**2.01 GENERAL**

- A. All products shall be in conformance with the Specifications listed below. Any changes to products to be used shall be approved, in writing, by the Owner or Owner's representative prior to job site delivery.

2.02 BARK/MULCH BIO BERM

- A. The compost filter berm material consists of compost or a blend of compost and mulch materials according to the specifications as follows.
- B. The filter berm material shall meet particle sizing specifications that when used in a filter berm system are tested in conformance with the outlined methods and scope of ASTM D6459 (latest revision), standard test method for determination of Erosion Controlled Blanket (ECB) Performance in Protecting Hill Slopes from Rainfall Erosion.
- C. The compost portion of the filter berm shall be derived from well-decomposed organic matter source produced by controlled aerobic (biological) decomposition that has been sanitized through the generation of heat and stabilized to the point that it is appropriate for this particular application. Compost material shall be processed through proper thermophilic composting, meeting the U.S. Environmental Protection Agency's definition for a 'process to further reduce pathogens' (PFRP). The compost portion shall meet the chemical, physical and biological properties outlined below.
 - 1. The pH shall be between 5.0 and 8.5 for berms to receive vegetation.
 - 2. Nitrogen Content: 0.5 - 2.0%.
 - 3. Soluble Salts: Maximum 5 mmhos/cm.
 - 4. Compost shall be weed and pesticide free, with manmade materials comprising less than 1%.

2.03 SEDIMENT FENCE

- A. Sediment Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths.
- B. Apparent Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751 (latest revision).
- C. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D4491 (latest revision).
- D. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355 (latest revision) after 500 hours exposure.
- E. Grab Tensile Strength-Supported: 100 lb-f, minimum, in cross-machine direction; 120 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632 (latest revision).
- F. Grab Tensile Strength-Unsupported: 90 lb-f, minimum, in cross-machine direction; 100 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632 (latest revision).
- G. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

H. Manufacturers:

1. BP Amoco, Amoco Fabrics and Fibers; www.geotextile.com.
2. TC Mirafi; www.tcmirafi.com.
3. Synthetic Industries; www.fixsoil.com.

2.04 BIO-FILTER BAGS

- A. Provide minimum size 18" x 6" x 30" plastic mesh bags with 1/2-inch openings filled with approximately 45 pounds of clean, 100% recycled wood-product waste.

2.05 SAND BAGS

- A. Provide 24" x 12" x 6" durable, weather-resistant, tightly woven bags sufficient to prevent leakage of filler material. Fill bags with at least 75 lbs. of firmly packed fine pcc aggregate 3/8" - 0 or round 3/8" - 3/16" pea gravel.

2.06 CATCH BASIN INSERT BAG / CURB INLET SEDIMENT DAM

- A. Provide prefabricated filter inserts manufactured specifically for collecting sediment in drainage inlets. Include handles and/or fasteners sufficient to keep the insert from falling into the inlet during maintenance and removal of the insert from the inlet. Insert bags shall be included on the Oregon Qualified Products List (QPL) for Type 3 Inlet Protection, or approved. Curb Inlet Sediment Dams shall be included on the Oregon QPL for Type 6 Inlet Protection, or approved.

2.07 COMPOST/ORGANIC SOIL MULCH BLANKET

- A. The blanket material consists of compost or a blend of compost and mulch materials according to the specifications as follows.
- B. The blanket material shall meet particle sizing specifications that when used in an erosion blanket system are tested in conformance with the outlined methods and scope of ASTM D6459 (latest revision), standard test method for determination of Erosion Controlled Blanket (ECB) Performance in Protecting Hill Slopes from Rainfall Erosion.
- C. The compost portion of the blanket material shall be derived from well-decomposed organic matter source produced by controlled aerobic (biological) decomposition that has been sanitized through the generation of heat and stabilized to the point that it is appropriate for this particular application. Compost material shall be processed through proper thermophilic composting, meeting the U.S. Environmental Protection Agency's definition for a 'process to further reduce pathogens' (PFRP). The compost portion shall meet the chemical, physical, and biological properties outlined below:
 1. The pH shall be between 5.0 and 5.5 for blankets to receive vegetation.
 2. Nitrogen Content: 0.5 - 2%.
 3. Soluble Salts: Maximum 5 mmhos/cm.
 4. Compost shall be weed and pesticide free, with manmade materials comprising less than 1%.

2.08 STRAW MULCH COVER

- A. Straw mulch for non-hydroseeding applications from bentgrass, bluegrass, fescue or ryegrass, singly or in combination. If grass seed straw is not available within a reasonable distance of the project, straw from barley, oat or wheat may be allowed upon approval of the Agency. Provide straw that is not moldy, caked, decayed, or of otherwise low quality. Submit certification from the supplier that the straw is free of noxious weed seeds or plant parts. Acceptable documentation will show either (1) that the straw source is from an "Oregon Certified Seed" field, or (2) the seed lab test results of the seed harvested from the straw meet minimum Oregon Certified Seed quality for weed seed content. Use a straw binder or tackifier.

2.09 EROSION BLANKET

- A. Erosion blanket to be Type 2, straw and coconut. Furnish blanket consisting of undyed, untreated, biodegradable, jute, coconut coir, synthetic polypropylene fibers, or approved yarn woven into a plain weave mesh with 5/8- to 1-inch square openings. Ensure material conforms to the following:

<u>Material</u>	<u>Specification Minimums</u>
Straw 70% *	
Coconut 30%	Straw and Coconut mass to be 0.5 lb/sy (0.25" minimum thickness)
Netting	Photodegradable netting on bottom side. 5/8 to 1-inch square mesh** with a 0.3 oz/sy weight.

* Moisture content shall not exceed 20%.

** Dimensions are approximate and may vary to meet manufacturer's standards.

Contech's 70% straw / 30% coconut meets these requirements.

2.10 SUBGRADE GEOTEXTILE

- A. Subgrade geotextile shall meet the requirements of Section 02 32 00, Geotechnical Investigations, and Section 31 20 00, Earth Moving.

2.11 GRASS SEED FOR TEMPORARY COVER

- A. Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- B. Seeds shall be of blue tag stock and from the current or latest season's crop and shall be in containers labeled in accordance with Oregon State and U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act.

2.12 HAY BALES

- A. Air dry, rectangular straw bales.
- B. Cross Section: 14 by 18 inches, minimum.
- C. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: Minimum 3 feet long, steel U- or T-section, with minimum mass of 1.33 lb. per linear foot, or wood, 2" x 2" in cross section.

2.13 EQUIPMENT

- A. Equipment used for application of slurry shall be a commercial-type Hydro-Seeder and have a built-in agitation system with an operation capacity sufficient to agitate, suspend and homogeneously mix slurry.
- B. Tank capacity shall be a minimum of 1,500 gallons and shall be mounted on a truck to allow access to the site.
- C. Pump shall be able to generate 150 psi at the nozzle.
- D. Straw blowers: Equipment shall be specifically designed and manufactured for the application of straw and shall be of sufficient horsepower to break up and distribute straw at the specified application rate.

PART 3 - EXECUTION**3.01 SOIL PREPARATION**

- A. No soil amendments shall be required except as noted on the Plans.
- B. Verification: Contractor shall verify:
 - 1. That all areas to receive erosion control treatments are free of vegetation and other objectionable material.
 - 2. That grades are final for permanently treated areas and within reasonable standard for temporary treatments.
 - 3. That all sloped areas are uniformly compacted: wherever possible, the surface compaction of the top 1 foot shall be 85% or less.

3.02 EROSION CONTROL BLANKET INSTALLATION

- A. Before placing the erosion control blankets, Contractor shall ensure the subgrade has been graded smooth and has no depressed voids. The subgrade must be free from obstructions, such as tree roots, projecting stones, or foreign matter greater than 1 inch in diameter. Install per manufacturer's specifications. Assure blanket overlap and staple frequency meet manufacturer's application guidelines. Apply seed to cut slope prior to blanket installation. Do not drive vehicles on the erosion control blanket.

3.03 TEMPORARY SEEDING AREA

- A. Areas to receive erosion control treatments include all graded areas as shown on the site plan and other areas as determined by the Owner.
- B. Perform erosion control treatments on a section by section basis. On approval of the Owner, and as soon as possible after grading, complete treatments in the following order of priority: stream zones, graded slopes, non-trafficked road and parking areas, building pads and other flat areas.
- C. When hydraulic seeder is used, seedbed preparation is not required.
- D. When surface soil has been sealed by rainfall or consists of smooth, undisturbed cut slopes and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
- E. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq. ft.
- F. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1,000 sq. ft.
- G. Adjust seed mixture as needed if applied during winter months.
- H. Incorporate fertilizer into soil before seeding.
- I. Apply seed uniformly; if using drill or cultipacker seeder, place seed 1/2 to 1 inch deep.
- J. Irrigate as required to thoroughly wet soil to depth that will ensure germination without causing runoff or erosion.
- K. Repeat irrigation as required until grass is established.
- L. Contractor shall be available to re-treat areas disturbed by on-going activities.
- M. Protection: Contractor is to stay off treated areas.
- N. Unused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at Contractor's expense.
- O. Preliminary Inspection: Notify the Owner's Representative 48 hours in advance of all seeding. Inspection and favorable review of completed work shall begin the plant establishment period.

3.04 PROTECTION AND MAINTENANCE

- A. Monuments: Carefully maintain bench marks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

- B. Existing Utilities: Existing utilities shall be field located. Protect active utility lines encountered. Repair or replace utility lines damaged by work of this Section.
- C. Pavement Cleaning: Maintain pavements and walkways clean at all times.
- D. Dust Control: Protect persons and property against damage and discomfort caused by dust; water as necessary and when directed.
- E. Other Work and Adjacent Property: Protect against damage caused by work of this section.

3.05 PLANT ESTABLISHMENT MAINTENANCE

- A. General plant maintenance shall immediately follow seeding and continue for **90 days**.
- B. Protect areas against all damage, including erosion and trespass, and provide proper safeguards. Maintain and keep in good repair all temporary barriers erected to prevent trespassing. Check all barrier and temporary fencing daily, and make immediate repairs or replacements
- C. Repair all damage to seeded areas.
- D. Maintain constant moisture depth in soil to insure vigorous growth.

3.06 FINAL INSPECTION AND ACCEPTANCE:

- A. Final inspection will be conducted upon completion of maintenance, replacements and corrective work. Five (5) days' notice shall be given. If project improvements, corrective work, and maintenance have not been performed as specified and to the satisfaction of the Owner's Representative, maintenance shall continue at Contractor's expense until such time as work has been successfully completed.

3.07 GUARANTEE AND REPLACEMENT

- A. Guarantee all planting to be in a healthy, thriving condition until the end of the maintenance period or beyond that time until active growth is evident and for one year from date of acceptance. *[These terms are to be determined by the Owner]*
- B. Replace all seeded areas not in vigorous condition as soon as directed by Owner's Representative. Seed mixture used for replacement must be of the same kind and quantity as specified in this section.

3.08 CLEAN-UP

- A. Erosion control work areas shall be maintained in a neat and orderly condition. Keep paved area free of erosion treatment, soil, and other debris.
- B. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Engineer.

- C. Clean out temporary sediment control structures that are to remain as permanent measures.
- D. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.
- E. Overspray: Installing Contractor is responsible for washing or otherwise cleaning excess material off all areas not intended to receive treatment.
- F. Debris: Clean up and remove erosion control associated materials and debris from project site before Final Acceptance.

END OF SECTION

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**SECTION 01 51 00
TEMPORARY UTILITIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCE STANDARDS

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

1.03 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Provide power service required from utility source.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- D. Provide main service disconnect and over-current protection at convenient location and meter.
- E. Permanent convenience receptacles may be utilized during construction.
- F. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.04 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- 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.

1.05 TEMPORARY HEATING

- A. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- B. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.06 TEMPORARY COOLING

- A. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- B. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.07 TEMPORARY VENTILATION

- A. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.08 TEMPORARY WATER SERVICE

- A. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 60 00
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 DEFINITIONS

- A. Products: Items purchased for incorporation in Work.
 - 1. Term "product" includes terms "material," "equipment," "system," and terms of similar intent.
 - 2. "Named Products" are items identified by manufacturer's product name, including make or model number or other designation, listed in manufacturer's published product literature.
- B. The term; 'Basis of Design', is used when a single product or system has been researched by the Architect and incorporated into the drawings and project manual. Generally the attributes for the Basis of Design are very specific.
 - 1. Listed manufacturers that are not the Basis of Design must be compared to those specific attributes and demonstrate that the quality and performance is comparable to or exceeds the product or system specified as basis of design.
 - a. Provide a two column attitude chart comparing the Basis of Design product or system with submitted product or system.
- C. Materials: Products shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of Work.
- D. Equipment: Product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.03 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; Prepared specifically for this Project and are not a copy of the contract drawing set.

1. Drawings to illustrate how the Contractor plans to meet the intent of contract's design requirements and explain fabrication and/or installation.
 2. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same kind from a single source to fullest extent possible.
- B. Compatibility of Products: Contractor is responsible for providing products and construction methods that are compatible with products and construction methods, or products specified to with those selected products to be compatible.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to manufacturer's recommendations.
- B. Schedule delivery to minimize long-term storage at site.
- C. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, or other losses.
- D. Deliver products to site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- E. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
- F. Store products at site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- G. Store products subject to damage by weather above ground, under cover in a weathertight enclosure, and with ventilation adequate to prevent condensation.
 1. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Product Substitutions:
 1. Where products or manufacturers are named and accompanied by term equal, approved, or approved equal, comply with Product Substitution Procedures to obtain approval of an unnamed product.
- B. Provide new products unless specifically required or permitted by Contract Documents.
- C. Specified Standards, Codes, and Regulations: Where compliance with an imposed code, standard, or regulation is specified, provide a product that complies with that code, standard, or regulation

- D. Visual Matching:
 - 1. Where matching a sample, Architect's decision will be final on whether a proposed product matches satisfactorily.
- E. Visual Selection:
 - 1. Where product requirements include phrase ". . as selected from manufacturer's standard colors, patterns, textures, .. " or a similar phrase, Architect will select color, pattern, and texture from product line selected that complies with other specified requirements.
- F. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 61 16.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only:
 - 1. Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers:
 - 1. Use a product of one of the manufacturers named and meeting specifications no options or substitutions allowed.
- C. Proprietary Specification Requirements:
 - 1. Single product or manufacturer is named, provide product indicated.
 - 2. No substitutions are permitted.
- D. Semi-proprietary Specification Requirements:
 - 1. Where two or more products or manufacturers are named, provide one of products indicated that complies with Specifications.
 - 2. No substitutions are permitted.
- E. Specified Standards, Codes, and Regulations: Where compliance with an imposed code, standard, or regulation is specified, provide a product that complies with that code, standard, or regulation.
- F. Inappropriate Product Selections:
 - 1. If Contractor believes specified product, method, or system is inappropriate for use, Contractor to notify Architect before performing Work in question.
 - a. Contractor to submit Product data and explain why product is inappropriate for use.
 - 2. If notice of objection is not received within 15 days of written notice, it will be assumed by Owner that Contractor agrees specified products, methods, and systems are appropriate for use in Project.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in applications indicated.
 - 1. Anchor each product securely in place, accurately located and aligned with other Work.
 - 2. Clean exposed surfaces and protect as necessary from damage and deterioration.
- B. Should job conditions or specified requirements conflict with Manufacturers' instructions, consult Architect for further instructions.

3.02 SUBSTITUTION LIMITATIONS

- A. Request for Substitutions shall be submitted to the Contractor for review and then submitted to Architect.
- B. Substitutions are considered only when proposed alternate is demonstrated as similar or greater value to what was specified. Address the following:
 - 1. The term; 'Basis of Design', is used when a single product or system has been researched by the Architect and incorporated into the drawings and project manual. Generally the attributes for the Basis of Design are very specific.
- C. Proposed Substitutions for Basis of Design must compare those specific attributes and demonstrate that the quality and performance is comparable to or exceeds the product or system specified.
 - 1. Provide a two column chart showing attributes for proposed substitution comparing those values to specified product or system.
 - 2. Provide a mark up of the design documents indicating how changes of proposed product or system will be required.
- D. Substitutions: Contractor proposals for changes in products, materials, equipment, and methods of construction required by Contract Documents made during bidding and after award of Contract are considered to be requests for substitution.
- E. Following are not considered to be requests for substitution for both Pre and Post Award:
 - 1. Revisions to Contract Documents requested by Owner or Architect.
 - 2. Specified Basis of Design options of products and construction methods included in Contract Documents.
 - 3. Contractor's determination of and compliance with regulations and orders issued by governing authorities.
- F. Substitutions received before execution of Contract will be processed as Addenda, if accepted, prior to execution of Contract, and thereafter included in Contract Documents.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without compliance with procedures outlined below, or when acceptance will require revision to the Contract Documents.
 - 1. Where manufacturers, products, or systems listed in Specifications are not followed with "or approved" or "Substitutions: Provide in accordance with requirements of Section 01 60 00" it is intended that substitutions are not permitted.
- H. Contractor's Responsibilities

1. Contractor's responsibilities for substitution requests made after award of Contract are as follows:
 - a. Investigate proposed products and determine they are equal or superior in respects to products specified.
 - b. Provide same guarantee for accepted substitutions as for products specified.
 - c. Make changes in, and coordinate, Work as may be required to incorporate and install accepted substitutions.
 - d. Waive claims for additional costs which subsequently become apparent which are related to substitutions.
- I. Architect will consider request for substitutions no less than 10 working days prior to Bid Date, unless otherwise stipulated in Instructions to Bidders.
- J. Equality of different materials or products shall be determined by methods set forth in this Section.
 1. No product or material shall be arbitrarily presumed to be "equal" without having first been so judged by appropriate procedures.
 2. Provide comparison chart itemizing specified parts or components of specified and proposed substitutions.
 - a. First column of chart is the specified product, second column is proposed product. Each row is a specified attribute or important attribute to performance.
 3. Comparative analysis to be evaluated by Architect or Engineer approving substitution.
 - a. Architect will be sole judge of acceptability of any proposed substitution and decision is final.

3.03 SUBSTITUTIONS REQUESTED AFTER AWARD OF CONTRACT

- A. Substitutions received after award of Contract: Requests for substitution received after award Contract will not be considered, except as a Contractor's Request for Change.
 1. Architect will be sole judge of acceptability of any proposed substitution.
 2. Substitutions reviewed in this manner will be processed as Change Orders, if accepted.
- B. Architect will receive and consider Contractor's request for substitution after award of Contract when one or more of following conditions are satisfied, as determined by Architect. If following conditions are not met, Architect will return requests without action except to record noncompliance with these requirements.
 1. Specified product cannot be provided within Contract time.
 - a. Architect will not consider request of products that: cannot be provided as a result of failure to pursue product promptly or coordinate activities properly.
 2. Specified product cannot receive necessary approval by a governing authority, and requested substitution can be approved.
 3. Specified product cannot be coordinated with other materials and Contractor certifies that proposed substitution can be coordinated.
 4. Specified product cannot provide required warranty and Contractor certifies that proposed substitution provides warranty.
 5. Requested substitution offers Owner a substantial advantage in cost and/or time after deducting additional Owner's cost of compensation to Architect for redesign and evaluation services, increased cost of other construction, and similar considerations.

- C. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.
- D. Substitution Submittal Procedure (after contract award):
 - 1. Submit electronic copy of request for substitution for consideration. Limit each request to one proposed substitution.
 - a. Provide specific conditions that substitution is requested as denoted above.
 - b. Submit request for approval of a substitution on Substitution Request Form, copy included at end of this Section.

3.04 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; 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. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.05 STORAGE AND PROTECTION

- A. Schedule delivery to minimize long-term storage at site.
- 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 74 19.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- F. For exterior storage of fabricated products, place on sloped supports above ground.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.

- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
 - 1. Maintain temperature and humidity within range required by manufacturer's instructions.
- J. Prevent contact with material that may cause corrosion, discoloration, or staining.
- K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- L. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SUBSTITUTION REQUEST FORM

TO: _____

PROJECT: _____

SPECIFIED ITEM: _____

SECTION _____ **PAGE** _____ **PARAGRAPH** _____

DESCRIPTION: _____

PROPOSED SUBSTITUTION

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request including identification of applicable data portions.

Attached data also includes description of changes to contract documents and proposed substitution requires for proper installation

UNDERSIGNED CERTIFIES FOLLOWING ITEMS, UNLESS MODIFIED BY ATTACHMENTS, ARE CORRECT:

1. Proposed substitution does not affect dimensions shown on drawings.
2. Undersigned pays for changes to building design, including engineering design, detailing, and construction costs caused by proposed substitution.
3. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
4. Maintenance and service parts available locally or readily obtainable for proposed substitution.

UNDERSIGNED FURTHER CERTIFIES FUNCTION, APPEARANCE, AND QUALITY OF PROPOSED SUBSTITUTIONS ARE EQUIVALENT OR SUPERIOR TO SPECIFIED ITEM.

UNDERSIGNED AGREES TO TERMS AND CONDITIONS FOR SUBSTITUTIONS FOUND IN BIDDING DOCUMENTS TO THIS PROPOSED SUBSTITUTION.

Submitted By: _____

Name (Printed or typed) _____ **General Contractor (if after award of Contract)**

SIGNATURE: _____ **FOR USE BY A/E** _____

FIRM NAME: _____ **APPROVED** **APPROVED AS NOTED**

ADDRESS: _____ **NOT APPROVED** **RECEIVED TOO LATE**

CITY, STATE, ZIP: _____ **BY:** _____

DATE: _____

TEL: _____ **REMARKS:** _____

**SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Pre-installation meetings.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

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,

- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.
- C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.04 PROJECT CONDITIONS

- A. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. 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 barriers between construction areas and areas continuing to be occupied by Owner.
- D. 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. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
- E. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- F. 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 60 00 - 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 misfabrication.
- 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 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within ten days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- G. Utilize recognized engineering survey practices.

- H. 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.
- I. Periodically verify layouts by same means.
- J. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING - SEE SECTION 01 73 29.

3.07 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. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 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.

3.09 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 79 00 - Demonstration and Training.
- B. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

3.11 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. 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.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Project Coordinator on preliminary observation to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion observation.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion observation.
- E. Conduct Substantial Completion observation and create Final Correction Punch List containing Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final observation.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 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

SECTION 01 73 29 CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for cutting, fitting, and patching of Work required to:
 - 1. Make several parts fit properly.
 - 2. Uncover work to provide for installing, inspecting, or both, of ill-timed work.
 - 3. Remove and replace work not conforming to requirements of Contract Documents.
 - 4. Remove and replace defective work.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Written Proposal: Where cutting and patching involves structural elements, submit proposal describing procedures. Include following information in proposal:
 - 1. Describe extent of cutting and patching required, how it will be performed, and why it cannot be avoided.
 - 2. Indicate changes to structural elements, and changes in appearance of visual elements. Include structural calculations.
 - 3. List products proposed for use and entities that will perform the Work.
 - 4. Indicate dates that work will be performed, duration of Work, and when work will be uncovered for Architect's observation.
 - 5. List utilities that cutting and patching work will affect.
 - 6. Submit cost estimate and secure Architect's approval of cost estimate and type of reimbursement before proceeding with cutting and patching

1.03 QUALITY ASSURANCE

- A. Structural Work:
 - 1. Do not cut and patch structural elements in a manner that would change their load carrying capacity or load deflection ratio.
 - 2. Obtain approval before cutting and patching structural elements.
- B. Do not cut and patch operating elements in a manner that would reduce their capacity to perform as intended, cause increased maintenance, or decreased operational life or safety.
- C. Do not cut and patch exposed elements of construction that in Architect's opinion would reduce visual aesthetic qualities, or result in visual evidence of cutting and patching.
 - 1. Remove and replace construction cut and patched in a visually unacceptable manner.

1.04 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Cut and patch construction using methods and with materials in such a manner as to not void any warranties required or existing.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Use new materials identical to existing materials.
- B. Exposed surfaces: Where identical materials are not available, use materials that visually match existing adjacent surfaces as nearly as possible.
- C. Use materials whose installed performance is equal or better to that of existing materials.

PART 3 EXECUTION

3.01 INSPECTION

- A. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
- B. After uncovering Work, inspect conditions affecting installation of new Work.
- C. Discrepancies: If uncovered conditions are not as anticipated, immediately notify Architect and secure direction before proceeding further.
 - 1. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Provide temporary support of work to be cut, including shoring and bracing as required to maintain structural integrity of Work.
- B. Protect existing construction during cutting and patching to prevent damage.

3.03 PERFORMANCE

- A. Use skilled workers trained and experienced in necessary crafts and familiar with requirements and methods required to restore surfaces to their original condition.
- B. Perform excavating and backfilling in accordance with applicable requirements of Division 2 Sections of these Specifications.
- C. Provide dust proof barriers where necessary to protect existing surfaces.

3.04 CUTTING

- A. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- B. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- C. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. When masonry construction must be pierced, furnish and install a steel pipe sleeve in opening and grout in place neatly.
 - 1. Leave grout surface to match existing finish.
 - 2. Fabricate sleeve one inch in diameter larger than pipe or insulation.
 - 3. Back and caulk between sleeve and pipe with waterproof sealant.
 - 4. At penetrations of fire-resistant rated walls, partitions, ceiling, or floor construction: Seal voids with fire-resistant rated materials as require to maintain assembly of fire-resistant rating of penetrated element, or as required by Building Code.
- 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. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- J. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.
- K. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.05 PATCHING

- A. Restore work with new products in accordance with requirements of Contract Documents.
 - 1. Perform fitting and adjusting of products to provide a finished installation complying with tolerances and finishes specified for type of construction involved.
 - 2. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- B. 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.
- C. Refinish surfaces to match existing adjacent finish, patching with seams that are durable and as invisible as possible.
 - 1. Where possible, inspect and test patched area to demonstrate integrity of seam.
 - 2. For continuous surfaces, refinish to nearest intersection or natural break.
 - 3. For assembly, refinish entire unit.
 - 4. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining work in manner that will eliminate evidence of patching and refinishing.
- D. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

- E. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.
- F. Where replacement of equipment and fixtures is required, restore existing plumbing, heating, ventilation, air-conditioning, electrical, and similar systems to full operational condition.
- G. When finished surfaces are cut so that smooth transition with existing or new work is not possible, submit to Architect, for approval, recommendation for terminating surface along straight line at natural line of division.
 - 1. Where change of plane of 1/4 inch or more occurs, submit to Architect, for approval, recommendation for providing smooth transition.

3.06 CLEANING

- A. Clean areas and spaces where cutting and patching work is performed.

END OF SECTION

SECTION 01 74 19
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. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood.
 - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 10 00 - Site Clearing for use options.
 - 6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 7. Glass.
 - 8. Gypsum drywall and plaster.
 - 9. Plastic buckets.
 - 10. Paint.
 - 11. Plastic sheeting.
 - 12. Rigid foam insulation.
 - 13. Windows, doors, and door hardware.
- E. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- G. 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.
- H. 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. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.
 - 1. Waste Management Plan: Submit draft plan with landfill alternatives as outlined herein.
- C. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.

2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
 7. Source Reduction: List processes that minimize waste such as working with suppliers to take back or buy back substandard, rejected or unused items and to deliver supplies using returnable pallets and containers. Also include procedures to minimize breakage, mishandling, contamination, and other factors that reduce job site waste.
 8. Meetings: A description of regular meetings to be held to address waste management.
 9. Indicate any instance where compliance with requirements of this specification does not appear to be possible and request resolution from the Owner and Architect.
- D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 2. Submit Report on a form acceptable to Owner.
 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.

- b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
 7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 01 60 00 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 60 00:
 1. Relative amount of waste produced, compared to specified product.
 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 3. Proposed disposal method for waste product.
 4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 20 00 - Price and Payment Procedures: Payment procedures.
 1. Submit with each Application for Progress Payment a Summary of Waste Generated by the Project.
 2. Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment.
 3. Summary shall be submitted on a form acceptable to the Owner and shall contain the following information:
 - a. Amount of waste (in tons) landfilled from the Project, the identity of the transfer station/landfill, the total amount of tipping fees paid at the landfill, the transportation cost, and the total disposal cost. Include manifests, weight tickets, receipts, and invoices.
 - b. For each material recycled, reused, or salvaged from the Project, the amount (in tons), the date removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling each material. Attach manifests, weight tickets, receipts, and invoices.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. 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.
- C. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Conduct Construction Waste Management meetings.
 - 2. Include subcontractors affected by the Waste Management Plan as well as Owner designated representative(s).
 - 3. Preconstruction meeting.
 - 4. Regular job-site meetings.
- D. 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. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 - 2. Provide containers as required.
 - 3. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 4. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
 - 5. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- E. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- F. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- G. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- H. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

**SECTION 01 78 00
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. As-Constructed Record Documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.
- D. Inspection procedures

1.02 DEFINITIONS:

- A. As-Constructed Record Documents: Record documents based on information the Contractor provides under the contract for construction to the Owner. Architect is not responsible for the accuracy or completeness of the As-Constructed Record Documents.

1.03 SUBMITTALS

- A. As-Constructed Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUBSTANTIAL COMPLETION

- A. Prior to requesting inspection for certification of Substantial Completion, complete following.
 - 1. In Application for Payment that coincides with, or first follows, date of Substantial Completion is claimed, show 100 percent completion for portion of Work claimed as

- substantially complete.
- a. Include supporting documentation for completion as indicated in these Contract Documents.
 - b. If 100 percent cannot be shown, include a list of incomplete items, value of incomplete construction, and reasons Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
 3. Submit warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 4. Obtain and submit releases enabling Owner unrestricted use of Work and access to services and utilities.
 - a. Include occupancy permits.
 5. Submit:
 - a. As-Constructed Record Drawings
 - b. As-Constructed Record Specifications
 - c. Maintenance manuals
 - d. Final project photographs
 - e. Damage or settlement surveys
 - f. Property surveys
 - g. Other final record information.
 6. Deliver tools, spare parts, extra stock, and similar items.
 7. Make final changeover of permanent locks and transmit keys to Owner.
 - a. Advise Owner's personnel of changeover in security provisions.
 8. Complete startup testing of systems and instruction to Owner's operation and maintenance personnel.
 9. Discontinue and remove temporary facilities from site, along with mockups, construction tools, and similar elements.
 10. Complete final cleanup requirements.
 11. Touch up and otherwise repair and restore marred, exposed finishes, including touchup painting.
- B. Inspection Procedures:
1. On receipt from contractor a written request for inspection with certification the project is substantially complete and a deficiency list, Architect will proceed with an inspection or advise Contractor of unfilled requirements.
 - a. Architect shall prepare a deficiency list within seven calendar days.
 2. Architect will prepare Certificate of Substantial Completion following inspection or advise Contractor of construction that must be completed or corrected before certificate can be issued.
 - a. Architect will reinspect once when requested with assurance that punch list and Work is substantially complete.
 - b. Results of completed inspection will form basis of requirements for Final Acceptance.
 3. Owner will allow Contractor no longer than 30 calendar days from Date of Substantial Completion to remedy deficiencies.

3.02 FINAL ACCEPTANCE

- A. Prior to requesting final inspection for certification of final acceptance and final payment, submit following:
 - 1. Final payment request with releases, including insurance certificates for products and systems where applicable.
 - 2. Updated final statement accounting for final additional changes to Contract Sum.
 - a. Architect will prepare a final Change Order after final acceptance showing adjustments to Contract Sum which were not made previously by Change Orders.
 - 3. Certified copy of Architect's final inspection list of items to be completed or corrected, endorsed and dated by Architect.
 - a. Certification to state each item has been completed or corrected or otherwise resolved for acceptance.
 - 4. Consent of Surety to Final Payment.
 - 5. Evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure:
 - 1. Architect will reinspect to verify status of completion upon receipt of notice that Work, including list of items from earlier inspection, has been completed.
 - a. Indicate items for which completion is delayed under circumstances acceptable to Owner and Architect.
 - 2. If Work is found to be complete following final inspection, Architect will issue a certificate of final acceptance.
 - 3. Should Architect and Owner determine that Work is incomplete or defective:
 - a. Architect will promptly notify Contractor, in writing, listing incomplete or defective Work.
 - b. Contractor to remedy deficiencies promptly, and notify Architect when ready for reinspection.

3.03 AS-CONSTRUCTED PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work and identify as AS-CONSTRUCTED RECORD DOCUMENTS - PROJECT SET:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Mark Drawings to show actual installation and construction where construction varies substantially from Work as shown.
 - 1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note.
 - 2. Date entries, and note related Change Order numbers where applicable.
 - 3. Call attention to entries by a "cloud" drawn around areas affected.
 - 4. Where overlapping changes occur, mark with different colors.

- C. Conversion of schematic layouts:
 - 1. Design of future modifications of facility may require accurate information as to final physical layout of items which are shown schematically on Drawings.
 - 2. Show on Project set of Record Drawings, by dimension accurate to within one inch, centerline of each run of items shown schematically on Drawings. Clearly identify item by accurate note such as "cast iron drain", "galv. water", and like. Show, by symbol or note, vertical location of item ("under slab", "in ceiling plenum", "exposed", and like). Relate by identification descriptive to Specifications
- D. Ensure entries are complete and accurate, enabling future reference by Owner.
- E. Store record documents separate from documents used for construction.
- F. Record information concurrent with construction progress.
- 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. Show changes in actual Work performed in comparison with Specification text.
 - 3. Product substitutions or alternates utilized.
- H. As-Constructed Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Field changes of dimension and detail.
 - 3. Details not on original Contract drawings.
- I. Final As-Constructed Record Documents: Prior to request for Substantial Completion, secure from Architect at no charge to Contractor two (2) complete sets of bond copies of Contract Drawings or electronic documents (DWG, PDF, WORD or EXCEL) .
 - 1. Carefully transfer change data shown on Project set of Record Documents to corresponding bond or electronic copy, coordinating changes as required.
 - 2. Clearly indicate at each affected detail and other drawings a full description of changes made during construction, and actual location of items.
 - 3. Show final location of electrical junction boxes and outlets, telephone and data outlets, supply and return registers, and like.
 - 4. Call attention to entries by a "cloud" drawn around areas affected.
 - 5. Make changes neatly, consistently, and with proper media to assure longevity and clear reproduction.
- J. Electronic Files:
 - 1. Delivery Medium: On CD.
 - 2. Provide record drawings in DWG format.
 - 3. File Naming: Include project identification and sheet identification.
 - a. Maintain sheet layer system and make separate layers for record document items.
 - 4. Individual files to be bind together.

3.04 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.

3.05 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.06 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.

- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Additional Requirements: As specified in individual product specification sections.

3.07 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- K. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.

- L. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- M. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.08 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.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Conveying systems.
 - 6. Landscape irrigation.
 - 7. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.02 SUBMITTALS

- A. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Architect for transmittal to Owner.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Provide an overall schedule showing all training sessions.
 - 4. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- B. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- F. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner.
- G. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.

2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 3. Typical uses of the O&M manuals.
- H. Product- and System-Specific Training:
1. Review the applicable O&M manuals.
 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 6. Discuss common troubleshooting problems and solutions.
 7. Discuss any peculiarities of equipment installation or operation.
 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 10. Review spare parts and tools required to be furnished by Contractor.
 11. Review spare parts suppliers and sources and procurement procedures.
- I. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

**SECTION 02 41 00
DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Abandonment and removal of existing utilities and utility structures.

1.02 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

- A. Remove the entire building as indicated on Civil demolition plans.
- B. Remove paving and curbs as required to accomplish new work.
- C. Remove all other paving and curbs within site boundaries.
- D. Break up paving within site boundaries to permit natural moisture drainage; leave pieces not larger than 1 square yard.
- E. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.
- F. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.
- G. Remove concrete slabs on grade within site boundaries.
- H. Break up concrete slabs on grade within site boundaries to permit natural moisture drainage; leave pieces not larger than 1 square yard.

- I. Remove underground tanks.
- J. Remove underground tanks that contain or once contained petroleum products; fill and bury other types of tanks.
- K. Remove manholes and manhole covers, curb inlets and catch basins.
- L. Remove fences and gates.
- M. Remove creosote-treated wood utility poles.
- N. Remove other items indicated, for salvage, relocation, recycling, and ____.
- O. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permit.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.
- F. Underground Storage Tanks: Remove and dispose of as specified in Section 02 65 00.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE (CIP)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Concrete building frame members.
- C. Floors and slabs on grade.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Miscellaneous concrete elements, including equipment pads and equipment pits.
- G. Concrete curing.
- H. Concrete finishing.
- I. Underslab Vapor Barrier.
- J. Waterstops associated with waterproofing systems specified elsewhere.

1.02 REFERENCE STANDARDS

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).
- B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.
- C. ACI 301 - Specifications for Concrete Construction 2020.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).
- F. ACI 305R - Guide to Hot Weather Concreting 2020.
- G. ACI 306R - Guide to Cold Weather Concreting 2016.
- H. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).
- I. ACI 347R - Guide to Formwork for Concrete 2014 (Reapproved 2021).
- J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).
- K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- L. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement 2022a.
- M. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
- N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

- O. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).
- P. ASTM C928/C928M - Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs 2020a.
- Q. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022a.
- R. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.
- S. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.
- T. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.
- U. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2023, with Editorial Revision.
- V. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.
- W. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.
- X. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars 2022.
- Y. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics 2016.
- Z. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- AA. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers 2020.
- BB. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric) 2014.
- CC. 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.
- DD. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs 2017.
- EE. ASTM E966 - Standard Guide for Field Measurements of Airborne Sound Attenuation of Building Facades and Facade Elements 2018a.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
- D. Shop Drawings shall contain sufficient detail and information to allow complete fabrication, bending, and placement of steel reinforcement without reference to the contract drawings

either on the fabrication shop floor or at the project site.

1. Detailer shall generate all shop drawings including fabrication and installation details from the structural and architectural drawings and specifications. The use of reproductions or photocopies of the contract drawings are not permitted. When CAD or REVIT files are provided, it is the responsibility of the detailers to remove all information not directly relevant to the creation of the placing drawings as well as all references to the outside sources of the files.
 2. Include plans for all slabs and elevations for all concrete beams, walls, and columns to show bar arrangement. Plans and elevations to include special reinforcement required for openings through concrete structures.
- E. Reinforcement Shop Drawings:
1. Show bar arrangement identifying size, shape, grade, and location of steel reinforcement. Include bar material, grade, sizes, lengths, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical and welded connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
 2. Submit steel reinforcing placement drawings prior to fabrication of reinforcing.
 3. Comply with requirements in ACI.
 4. Identify and dimension each type of reinforcing bar.
- F. Mix Design: Submit concrete mix designs, along with test data compliant with IBC, at least two weeks prior to placing concrete.
- G. Test Reports: Submit report for each test or series of tests specified.
- H. Certificates: Submit letter from concrete supplier that concrete delivered meets requirements of this Specification.
- I. Finisher Certification: Provide a list of finishers on project certified by ACI.
- J. Batch Ticket:
1. Provide a batch weight ticket with each truck for inspection agency.
 2. Comply with requirements of ASTM C94/C94M, Batch Ticket Information.
- K. Test Reports:
1. Submit copies of laboratory and field test reports for concrete Work.
 2. Refer to Section 01 40 00 - Quality Requirements.
 3. Reinforcement Test Reports: Submit two copies of mill test reports on grade 60 reinforcing prior to placing concrete.
- L. Sustainable Design Submittals:
1. Foam Certificates: Certify that foam fill meet or exceed specified requirements.
 2. If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.
- M. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.
- N. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Acquire cement from same source and aggregate from same source for entire project.
- C. Follow recommendations of ACI 305R when concreting during hot weather.
- D. Follow recommendations of ACI 306R when concreting during cold weather.
- E. 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.
- F. Reinforcing Steel Standards:
 - 1. CRSI Manual of Standard Practice
 - 2. ACI 318, Building Code Requirements for Reinforced Concrete, Commentary on Building Code Requirements for Reinforced Concrete.
 - 3. ASTM A615/A615M.
 - 4. ASTM ASTM A1064/A1064M.
- G. Mix Design Qualifications: Employ testing laboratory or concrete supplier acceptable to Architect to perform materials evaluation, testing, and design of concrete mixes.
- H. Finisher Certification: Certified ACI finisher.
- I. Plant Certification:
 - 1. Ready Mix Plant to follow NRMCA certification regulations.
 - 2. Ready Mix Plant and Equipment: Comply with requirements of ASTM C94/C94M.
- J. Mixing and Delivery Equipment:
 - 1. Maintain scales, mixers, trucks, storage bins and conveyors in good working condition.
 - 2. Clean mixing and delivery equipment as required by:
 - a. ASTM C94/C94M.
 - b. National Ready-Mixed Concrete Association, NRMCA.
 - c. Testing Agency: Document design mix requirements.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Slabs with 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.
 - 2. Provide warranty by admixture manufacturer matching terms of flooring adhesive or primer manufacturer's material defect warranty.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcement to the job site bundled, tagged, and marked.
 - 1. Tag to indicate bar size, lengths, and other information corresponding to markings shown on Shop Drawing placement diagrams.
- B. Store reinforcement in a manner to prevent damage and accumulation of dirt and excessive rust.

1.07 SITE CONDITIONS

- A. Temperature and Weather Requirements:
 - 1. Do not place concrete when temperature or weather will affect performance or appearance of concrete.
 - 2. Maximum wind velocity for unprotected floor slabs, stairs, ramps, walks and curbs: 15 mph.
 - 3. Minimum Ambient Air Temperature: 40 degrees F.
 - 4. No precipitation expected within 8 hours for unprotected concrete surfaces.
- B. Substrate Requirements:
 - 1. Do not place concrete on muddy or frozen soil.
 - 2. Remove water and ice from footing trenches.
 - 3. Remove ice from formed surfaces.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
 - 1. Design formwork, shores, reshores, and backshores to carry all loads transmitted to them and to comply with requirements of applicable building code.
 - a. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.
 - 2. Do not use earth cuts as forms for vertical or sloping surfaces unless required or permitted by Contract Documents.
 - 3. Maximum deflection of facing materials reflected on concrete surfaces exposed to public view shall be L/240 of span between structural members of formwork.
 - 4. Formed Construction: Locate and form construction joints that least impair strength of structure. Unless otherwise specified or permitted, locate and detail formed construction joints to following requirements:
 - a. Locate construction joints within middle third of spans of slabs, beams, and girders. When a beam intersects a girder at this point, offset joint in girder a distance equal to or greater than twice width of beam.
 - b. Locate joints in walls and columns at underside of floors, slabs, beams, or girders and at tops of footings or floor slabs.
 - c. Make joints perpendicular to main reinforcement.
 - d. Provide keyways as indicated in Contract Documents.
 - 5. Corners: Chamfered, rigid plastic; 3/4 x 3/4 inch size; maximum possible lengths.
- 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: Steel.
 - 2. Reveal Material: Polyvinyl chloride.
 - a. Size: As shown on drawings.
 - b. Provide products manufactured by Victory Bear Construction Products; www.victorybear.com.

- c. Substitutions: See Section 01 60 00 - Product Requirements.
3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 1. Type: Deformed billet-steel bars.
 2. Finish: Unfinished, unless otherwise indicated.
- B. Weld Type Reinforcing Steel: ASTM A706/A706M, Grade 60 (420) deformed low-alloy steel bars.
 1. Unfinished.
- C. Reinforcement Accessories:
 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type 2 Portland type.
 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Slag: Ground granulated blast furnace slag per ASTM C989/C989M.
- E. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
 1. Concentration: Base dosage rates on weight of Portland cement, fly ash, silica fume, and other cementitious materials but not aggregate or sand.
 2. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).
 3. Products:
 - a. Butterfield Color: www.butterfieldcolor.com.
 - b. Davis Colors: www.daviscolors.com.
 - c. Lambert Corporation: www.lambertusa.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Moisture Vapor Reducing Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs). Closes capillary systems formed during concrete curing to reduce

moisture vapor emission and transmission. Reduces concrete shrinkage with no adverse effect on concrete properties or applied flooring.

1. Provide admixture in slabs to receive adhesively applied flooring.
2. Products:
 - a. AVECS, LLC; PRO-ACT: www.avecs.build.
 - b. Barrier One Concrete Admixtures; MVRA-CPS: www.barrierone.com.
 - c. ISE Logik Industries, Inc; MVRA 900: www.iselogik.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Air Entrainment Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: ASTM C494/C494M, Type A - Water Reducing and Type D - Water Reducing and Retarding.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Barrier: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
 1. Vapor Barrier membrane must have the following minimum properties.
 - a. Minimum 15-mil thick polyolefin geomembrane.
 - b. Water Vapor Barrier: ASTM E1745; Meets or exceeds Class A.
 - c. Water Vapor Transmission Rate: ASTM E966, 0.006 gr./ft²/hr. or lower.
 - d. Permeance Rating: ASTM E96/E96M, 0.01 gr./ft²/hr. or lower.
 - e. Puncture Resistance: ASTM E1745, minimum 1970 grams.
 - f. Tensile Strength: ASTM E1745, minimum 45.0 lbf/in.
 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
 - a. Seam Tape
 - 1) High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches.
 - b. Pipe Boots
 - 1) Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.
 3. Products:
 - a. Basis of Design: Stego Industries, LLC; Vapor Barrier (15 mil); www.stegoindustries.com.
 - b. Fortifiber Building Systems Group; Moistop Ultra 15: www.fortifiberflooring.com.
 - c. Reef Industries, Inc.; Product: Vaporguard; www.reefindustries.com.
 - d. Poly-America; Husky Yellow Guard 15 mil Yellow Guard Vapor Barrier: www.yellowguard.com/#sle.
 - e. Raven Industries; Product: Vapor Block 15; www.ravenind.com.
 - f. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils: www.wrmeadows.co.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Non-Shrink Cementitious Grout: 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.
- C. Capillary Break:
1. Self draining, 3/4 -1/4 inch aggregate with no more than 2 percent passing #200 sieve.
 2. Thickness: 8 inches

2.06 BONDING AND JOINTING PRODUCTS

- A. Cementitious Patching Compound:
1. Standards:
 - a. ASTM C928/C928M.
 - b. ASTM C157 (maximum air length change - .09%).
 2. Horizontal cementitious patching compound:
 - a. US SPEC H2 or Quickset 20 by US Mix Co.
 - b. SD2 Repair Mortar by BASF Building Systems.
 3. Vertical or Overhead cementitious patching compound:
 - a. US SPEC V/O Patch by US Mix Co.
 - b. Gel Patch by BASF Building Systems.
- B. Bentonite Waterproofing Waterstops: Waterstops associated with systems specified in Section 07 17 13.
1. Type 1:
 - a. Purpose: Construction cold-joints in cast-in-place construction.
 - b. Properties:
 - 1) Shape: Rectangular.
 - 2) Minimum Cover: 3 inch
 - 3) Minimum Wall Thickness: 8 inch
 - 4) Hydrostatic Head Resistance: 231 feet
 - c. Manufacturer: CETCO; www.mineralstech.com
 - 1) Product: Waterstop RX-101
 2. Type 2:
 - a. Purpose: Penetrations.
 - b. Properties:
 - 1) Shape: Half-circle.
 - 2) Minimum Cover: 2 inch
 - 3) Minimum Wall Thickness: 6 inch
 - 4) Hydrostatic Head Resistance: 231 feet
 - c. Manufacturer: CETCO; www.mineralstech.com
 - 1) Product: Waterstop RX-102
 3. Type 3:
 - a. Purpose: Construction cold-joints in shotcrete construction.
 - b. Properties:
 - 1) Shape: Trapezoid.
 - 2) Minimum Cover: 3 inch.
 - 3) Minimum Wall Thickness: 8 inch
 - 4) Hydrostatic Head Resistance: 231 feet

- c. Manufacturer: CETCO; www.mineralstech.com
 - 1) Product: Waterstop RX-101T
- C. Fluid-Applied Waterproofing Waterstops: Waterstops associated with systems specified in Section 07 14 00.
 - 1. Type 1:
 - a. Purpose: Construction cold-joints in cast-in-place construction.
 - b. Properties:
 - 1) Shape: Rectangular.
 - 2) Minimum Cover: 3 inch
 - 3) Minimum Wall Thickness: 8 inch
 - 4) Hydrostatic Head Resistance: 233 feet
 - c. Manufacturer: CETCO; www.mineralstech.com
 - 1) Product: Waterstop RX-101
 - 2. Type 2:
 - a. Purpose: Penetrations.
 - b. Properties:
 - 1) Shape: Half-circle.
 - 2) Minimum Cover: 2 inch.
 - 3) Minimum Wall Thickness: 6 inch.
 - 4) Hydrostatic Head Resistance: 233 feet
 - c. Manufacturer: CETCO; www.mineralstech.com
 - 1) Product: Waterstop RX-102
- D. Construction Joint Devices: Integral galvanized steel; 1/8 inch thick, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.
- E. Sealant and Primer: As specified in Section 07 92 00.

2.07 CURING MATERIALS

- A. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A,
 - 1. Application: Use at exposed horizontal, and vertical surfaces.
 - 2. Vehicle: Water-based.
 - 3. Solids by Mass: 25 percent, minimum.
 - 4. Products:
 - a. Dayton Superior Corporation; Cure & Seal 1315: www.daytonsuperior.com.
 - b. US Mix Co: Product: US SPEC CS-30-1315.
 - c. W. R. Meadows, Inc; CS-309-30 OTC: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
 - 1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301 and scheduled.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: As indicated on structural drawings or 3000 psi minimum where not indicated.
 - 2. Fly Ash Content: Maximum 20 percent of cementitious materials by weight.
 - 3. Water-Cement Ratio:
 - a. Slabs on Grade and Suspended Slabs: 0.42
 - b. Others: 0.48.
 - 4. Total Air Content: 5 percent, per ASTM C 173. Provide at exterior horizontal surfaces exposed to weather.
 - 5. Maximum Slump: 4 inches (+/- 1").
 - 6. Maximum Aggregate Size: As indicated on structural drawings
 - 7. Maximum Aggregate Size: 3/4 inch, slabs and walls; 1 1/2 inch at footings.

2.09 MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix and deliver according to ASTM C 94.
 - 1. Furnish batch ticket information.
 - 2. Transit Time, includes mixing and delivery:
 - a. 1 1/2 hrs for air temperatures below 85 degrees F.
 - b. 75 minutes for air temperatures between 85 and 95 degrees F.
 - c. 60 minutes for air temperatures above 90 degrees F.
- B. 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.
 - 1. Obtain Architect and Structural Engineer approval before adding water.
 - 2. Record added water to mix in field report with amount of water added and location.
- C. Do not use shrinkage-reducing admixture (SRA) in same concrete batch with MVRA or PIA.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
 - 1. Construct formwork so concrete structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Install Capillary Break at slab on grade.

1. Compact capillary break aggregate.
2. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D2922.
 - a. Compact to 95 percent of maximum dry density.
 - b. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor").
- D. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

3.03 UNDER SLAB VAPOR BARRIER INSTALLATION

- A. Installation shall be in accordance with manufacturer's instructions and ASTM E1643.
- B. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
- C. Lap Vapor Barrier over footings and seal to foundation walls.
- D. Overlap joints 6 inches and seal with manufacturer's tape.
- E. Seal all penetrations (including pipes) with manufacturer's pipe boot.
- F. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
- G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.
- H. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by taping edges and ends.

3.04 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

3.05 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Notify Architect not less than 24 hours prior to commencement of placement operations.
- C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Screed floors level, maintaining the following minimum F(F) Floor Flatness and F(L) Floor Levelness values when measured in accordance with ASTM E1155/ASTM E1155M.
 1. Non-Critical areas, thick-bed tile and parking structures:
 - a. F(F): Specified Overall Value (SOV) of 20; Minimum Localized Value (MLV) of 15.
 - b. F(L): Specified Overall Value (SOV) of 15; Minimum Localized Value (MLV) of 10.
 2. Carpet areas :
 - a. F(F): Specified Overall Value (SOV) of 25; Minimum Localized Value (MLV) of 17.
 - b. F(L): Specified Overall Value (SOV) of 17; Minimum Localized Value (MLV) of 15.

3. Wood, Resilient and Thinset Flooring:
 - a. F(F): Specified Overall Value (SOV) of 50; Minimum Localized Value (MLV) of 35.
 - b. F(L): Specified Overall Value (SOV) of 50; Minimum Localized Value (MLV) of 35.
- B. Screed suspended slab flatness level, maintaining the following minimum F(F) Floor Flatness and F(L) Floor Levelness values when measured in accordance with ASTM E1155/ASTM E1155M.
 1. Non-Critical areas, thick-bed tile and parking structures:
 - a. F(F): Specified Overall Value (SOV) of 20; Minimum Localized Value (MLV) of 13.
 - b. F(L): Specified Overall Value (SOV) of 15; Minimum Localized Value (MLV) of NA.
 2. Carpet areas:
 - a. F(F): Specified Overall Value (SOV) of 25; Minimum Localized Value (MLV) of 16.
 - b. F(L): Specified Overall Value (SOV) of 15; Minimum Localized Value (MLV) of NA.
 3. Wood, Resilient and Thinset Flooring:
 - a. F(F): Specified Overall Value (SOV) of 50; Minimum Localized Value (MLV) of 31.
 - b. F(L): Specified Overall Value (SOV) of 50; Minimum Localized Value (MLV) of NA.
- C. 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.
- D. Correct the slab surface if tolerances are less than specified.
- E. 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 1/8 inch or more in height. Provide finish as follows:
 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 - a. Provide smooth form finish for concrete exposed to public view.
 - b. Comply with ACI 301.
 - c. Remove fins and projections.
 - d. Patch tie holes and defects.
 2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 1. 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.
 - a. Power trowel slab to smooth surface free of defects except minor trowel marks.
 - b. Eliminate trowel marks by hand troweling slab when surface is sufficiently hard.
 - c. Perform final hand troweling when trowel rings as trowel is moved over slab surface.

- d. Trowel to tolerances defined by ACI F Numbers specified.
- e. Grind slab surfaces or fill with underlayment to remove defects of sufficient magnitude to show through intended floor covering.
2. Special Concrete Floor Finishing: See Section 03 35 16.
3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
4. Broom Slab Finish:
 - a. Provide broom finish for interior, slabs on grade as indicated on drawings.
 - b. Comply with ACI 301.
 - c. Provide a floated finish as specified above.
 - d. Draw a broom or burlap belt across surface to give slab a course transverse scored texture.
- E. Joint Finishing:
 1. Tool radius exterior slab, walk, ramp, and curb edges.
 2. Cut or form interior floor slab crack control joints.
 3. Cut or form exterior curb slab and ramp crack control joints.

3.08 CURING AND PROTECTION

- A. Exterior Curing:
 1. Roofs, Exterior Decks and Balconies: Wet cure with moisture-retaining cover for minimum 7 days.
 - a. Curing and sealing compounds not permitted.
 2. Exterior Concrete: Spray apply solvent based or acrylic curing compound to concrete surface after finishing as soon as concrete is free of surface water, at manufacturer's recommended rate.
- B. Interior Exposed Concrete Floors: Apply Moisture-Retaining Cover material per manufacturer's recommendations at surfaces scheduled as exposed concrete or sealed concrete per Room Finish Schedule .
- C. Interior Exposed Concrete Floors: Apply liquid concrete curing material per manufacturer's recommendations at surfaces scheduled as exposed concrete or sealed concrete per Room Finish Schedule.
 1. Upon completion of all interior finishes and prior to substantial completion, clean exposed floors and apply two coats of concrete sealing compound.
 2. Confirm compatibility with curing materials.

3.09 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117.
 1. Exposed Cast-in Place Concrete: Class A.
 2. Concealed Cast-in Place Concrete: Class B.
- B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.10 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. 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.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. 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.
- I. Drill-In/Power-Driven Anchors
 - 1. Testing Agency shall verify procedures used for installation of concrete anchors and monitor their installation for compliance with manufacturer's requirements.
- J. Flatness and Levelness Tolerances:
 - 1. Measure floor slabs for suspended floors and slabs-on-grade to verify compliance with tolerance requirements of ASTM E 1155 and ACI 117.
 - 2. Floor Profiler:
 - a. Dipstick by Face Construction Technologies.
 - 3. Measure floor finish tolerances within 72 hours after slab finishing and before removal of supporting formwork or shoring.

3.11 REPAIRS

- A. Surface Repairs for Exposed Concrete:
 - 1. Thoroughly clean, dampen with water and brush-coat area to be patched with Bonding Agent.
 - 2. Fill honeycomb voids and rock pockets with patching compound.
 - 3. Compact in place and screed as recommended by patching compound manufacturer.
 - 4. Finish to match adjoining work.
 - 5. Strike off excess mortar at surface.
- B. If defects in color and texture of surface cannot be repaired, remove and replace concrete.

3.12 DEFECTIVE CONCRETE

- A. Test Results: 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, repair and replacement 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. Barricade area containing fresh concrete slabs, stairs, ramps and walks for 24 hours minimum.
- B. Cover fresh concrete with plywood where exposed to public, pedestrian, and animal traffic.

3.14 SCHEDULE

- A. Strengths (28-day strengths unless otherwise noted on structural drawings):
 - 1. Non-structural concrete: $F'c = 3.0$ ksi.
 - 2. Slab on ground, sidewalks, curbs, mechanical pads (provide polyfiber): $F'c=3.0$ ksi.
- B. Finish:
 - 1. Exposed Columns: Remove fins and protrusions, no rock pockets.
 - 2. Slabs: Steel trowel, typ. Broom finish at Parking Garage.
 - 3. Concealed Shear Walls: As is in place.
- C. Curing and Sealing:

LOCATION	INSTALL AT TIME OF POUR	INSTALL BY SUBSTANTIAL COMPLETION	COMMENTS
Polished Concrete	'A' - Curing Compound	X	Refer to Section 03 35 16 for additional requirements
Covered Horizontal	'B' - Moisture Intrusion Barrier	X	
Covered Vertical	'A' - Curing Compound	X	
Exposed Horizontal & Vertical	'D' - Curing and Sealing Compound	'C' - Sealing Compound	
Roofs	'D' - Curing and Sealing Compound	X	Verify compatibility with vapor barrier materials provided by roofing manufacturer

END OF SECTION

SECTION 03 35 16
SPECIAL CONCRETE FLOOR FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applying sealer, hardener and polishing concrete to specified benchmark levels.

1.02 REFERENCE STANDARDS

- A. ANSI B101.3: Test Method for Measuring the Wet DCOF of Hard Surface Walkways.
- B. ASME B46.1 - Surface Texture (Surface Roughness, Waviness and Lay) 2019.
- C. ASTM C1895 - Standard Test Method for Determination of Mohs Scratch Hardness; 2000.
- D. ASTM D5767 - Standard Test Method for Instrumental Measurement of Distinctness-of-Image (DOI) Gloss of Coated Surfaces; 2018.
- E. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials 2013 (Reapproved 2021).

1.03 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.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product data:
 - 1. Submit special concrete finishes manufacturer's specifications and test data.
 - 2. Submit special concrete finishes describing product to be provided, manufacturer's name and product name for specified material proposed.
 - 3. Submit special concrete finishes manufacturer's recommended installation procedures; which when approved by Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.
 - 4. Submit special concrete finishes technical data sheet giving descriptive data, curing time, and application requirements.
 - 5. Submit special concrete finishes manufacturer's Safety Data Sheet (SDS) and other safety requirements.
- C. Polishing Schedule:
 - 1. Submit plan showing polished concrete surfaces and schedule of polishing operations and slurry mitigation for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
- D. Test Reports:
 - 1. Provide certified test reports, prepared by an independent testing laboratory, confirming compliance with specified performance criteria.
- E. Material Certificates: For each of the following, signed by manufacturers:

1. Repair materials.
 2. Stain materials.
- F. Walkway Auditor: Test bonded abrasive polished floors for dynamic coefficient of friction according to ANSI B101.3.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Use an experienced installer and adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.
 2. Finish manufacturer shall certify applicator.
 3. Applicator shall be familiar with the specified requirements and methods needed for proper performance of work.
- B. Manufacturer's Certification:
1. Provide letter of certification from concrete finish manufacturer stating that installer is certified applicator of special concrete finishes, and is familiar with proper procedures and surface refinement installation requirements, including surface micro textures, reflectivity, and slurry mitigation.
- C. Protection
1. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential.
 - a. Hydraulic powered equipment must be diapered to avoid staining of the concrete.
 - b. No trade will park vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
 - c. No pipe cutting machine will be used on the inside floor slab.
 - d. Steel will not be placed on interior slab to avoid rust staining.
 - e. Acids and acidic detergents will not come into contact with slab.
 - f. Inform trades that slab must be protected.

1.06 MOCK-UP

- A. Construct mock-up area under conditions similar to those which will exist during actual placement, 10 feet long by 10 feet wide, with coatings applied.
- B. Apply mock-ups of each type finish, to demonstrate typical joints, surface finish, color variation (if any), and standard of workmanship.
1. Notify Architect seven days in advance of dates and times when mock-ups will be constructed.
 2. Obtain approval from Architect or Owner Representative of mock-ups before starting construction.
 3. If Architect determines that mock-ups do not meet requirements, demolish and remove them from site and cast others until mock-ups are approved.
 4. Maintain mock-ups during construction in an undisturbed condition as a standard for judging completed work.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original containers, with seal's unbroken, bearing manufacturer labels indicating brand name and directions for storage.
- B. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

1.08 FIELD CONDITIONS

- A. Coordinate the work with concrete floor placement and concrete floor curing.
- B. Flooring limitations:
 - 1. Comply with manufacturers written instructions for substrate conditions affecting topping performance.
 - a. Concrete Floor Flatness per Section 03 30 00.
 - b. Concrete Floor Levelness per Section 03 30 00.
 - c. Concrete must be cured a minimum of 45 days or as directed by manufacturer before application of Retro Plate can begin.
 - d. Application of polishing system: 10 days prior to installation of equipment and substantial completion.
- C. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.
- D. Temporary Lighting: Minimum 200 W light source, placed 8 feet above the floor surface, for each 425 sq ft of floor being finished.
- E. Do not finish floors until interior heating system is operational.
- F. Temporary Heat: Ambient temperature of 50 degrees F minimum.
- G. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

PART 2 PRODUCTS

2.01 POLISHED CONCRETE SYSTEM

- A. Polished Concrete System: Materials, equipment, diamond tooling, liquid applied products, slurry mitigation, floor protection, and procedures designed and furnished by a single manufacturer to produce dense polished concrete floor.
 - 1. Acceptable Systems:
 - a. Advanced Floor Products, Inc.; Product Retro-Plate 99, www.retroplatesystem.com.
 - b. Ardex Engineered Cements; DRI Polished Concrete System : www.ardexamericas.com.
 - c. L&M Construction Chemicals, Inc; Permashine: www.lmcc.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Performance Criteria:
 - 1. Image Clarity Value Level according to ASTM D5767.
 - a. Semi Gloss (46-75%),
 - 2. Surface Micro Texture Value: 16 micro inches, minimum according to ASME B46.1.
 - 3. Hardness: ASTM C1895.

4. Ultra Violet Light and Water Spray: ASTM G153; No adverse effect to ultra violet and water spray.
- C. Neutralizing Agent: Tri-sodium Phosphate
- D. Water: Potable

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate, with installer present, for conditions affecting performance of finish.
 1. Correct conditions detrimental to timely and proper work.
 2. Do not proceed until unsatisfactory conditions are corrected.
 3. Measure and record initial Ra averages for floor surface micro texture profile.
- B. Verify that base slab meet finish and surface profile requirements in Section 03 30 00 - Cast-In-Place Concrete and Project Conditions above.
- C. Prior to application, verify that floor surfaces are free of construction patents.

3.02 APPLICATION

- A. Follow special concrete finishes published manufacturer's installation instructions.
- B. Start floor finish applications in presence of manufacturer's technical representative.
- C. Refinement and Polishing of Concrete Surface:
 1. Concrete must be in place a minimum of 45 days or as directed by manufacturer before application can begin.
 2. Application is to take place at least 10 days prior to racking and other in-store accessory installation, thus providing a complete, uninhibited concrete slab for application
 3. Achieve hardening, dust-proofing, and abrasion resistance of surface without changing natural appearance of concrete, except for sheen.
 4. Polish to required sheen level.

3.03 CONCRETE POLISHING

- A. Execute using materials, equipment, and procedures capable of achieving approved benchmarks specified by manufacturer, using manufacturer approved installer.
 1. Final Distinctness of Image Gloss:
 - a. Semi-Gloss Finish: High traction according to ANSI B101.3.
 - b. Surface Micro Texture Grade Average: 16µin +/-5.
 2. Satin Finish: Reflecting images from side lighting.

3.04 CLEANING:

- A. Premises shall be kept clean and free of debris at all times.
- B. Remove spatter from adjoining surfaces, as necessary.
- C. Repair damages to surface caused by cleaning operations.
- D. Remove debris from jobsite
 1. Dispose of materials in separate, closed containers in accordance with local regulations.

3.05 PROTECTION:

- A. Protect finished work until fully cured in accordance with manufacturer's recommendations.
- B. Record and provide final data of DCOF, DOIG, and Ra per 01 78 00 Closeout Submittals.

END OF SECTION

**SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural precast concrete accessories.
- B. Supports, anchors, and attachments.

1.02 REFERENCE STANDARDS

- A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- B. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.
- C. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2021a.
- D. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.
- E. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- F. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, bearing pads, etc.
- C. Shop Drawings: Indicate layout, unit locations, configuration, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials.
 - 1. Location, dimensional tolerances, and details of anchorage devices that are embedded in to, or attached to, structure or other construction.
 - 2. Handling procedures and sequence of erection for special conditions and adjoining elements.
 - 3. Finishes.
- D. Maintenance Data: Indicate surface cleaning instructions.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Firm having at least 5 years of documented experience in production of precast concrete of the type required.
 - a. Completed a minimum of 3 projects of similar size and scope.
 - 2. Fabricator to show plant has experienced personnel, physical facilities, established quality control procedures and management capability to produce required units without causing delay to project.

3. Plant certified under Architectural Precast Association Plant Certification Program for production of architectural precast concrete.
- B. Installer Qualifications:
 1. Regularly engaged for a minimum of 5 years in erection of architectural precast concrete units similar to those required on this project.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle and transport units in a position consistent with their shape and design in order to avoid stresses which would cause cracking or damage.
- B. Handling: Lift and support precast units only from support points.
- C. 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.
- D. Protect units to prevent staining, chipping, or spalling of concrete.
- E. Do not place or store units directly on ground.
- F. Mark units with date of production in location that will be concealed after installation.
- G. Storage at Site:
 1. Store and protect units to prevent contact with soil, staining, and physical damage.
 2. Store units on firm, level, and smooth surfaces to prevent cracking, distortion, warping or other physical damage.
 3. Place stored units in a manner that identification marks are discernible, and product can be inspected.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Precast Concrete:
 1. Integrity Industries, LLC. DBA Cement Elegance; www.cementelegance.com.

2.02 PRECAST UNITS, GENERAL

- A. Type PCON-1: Precast Concrete Fireplace Hearth
 1. See Section 09 06 02 Materials and Finishes Schedule.
 2. All units to be structurally engineered and custom made using a precast, custom-blended, structurally reinforced Portland cement based concrete.
 3. Standard Thickness: 1 inch nominal.
 4. Standard Edge: Square edge, eased arris and corners. Options: Radius, chamfered, molded and custom edges.
 5. Color: See Manufacturer color samples.
 6. Standard Length: approximately 72 inches.
 7. Thickness: 1 inch.

8. Sealer: All units to be factory sealed with a high performance fully penetrating sealer. This sealer must exhibit the following properties:
 - a. Colorless.
 - b. Water and oil repellent.
 - c. Non-yellowing (UV resistant).
 - d. Highly heat resistant.
 - e. Stain resistant to food and oil when wiped up immediately.
 - f. Long lasting.
 - g. Environmentally safe.
- B. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.
- C. Mounting Support: Manufacturers standard rectangular 1 inch x 2 inch tube steel frame.

2.03 REINFORCEMENT

- A. Welded Wire Fabric: (CSA G30 series)
 1. Welded Steel: ASTM A 185

2.04 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
- B. Fine and Coarse Structural Aggregates: ASTM C 33, with coarse aggregates meeting Class 5S and MNL-117 requirements.
- C. Surface Finish Aggregate: Complying with sample in office of Architect.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
- E. Fiber Reinforcement: Synthetic fiber shown to be resistant to long-term deterioration when exposed to moisture and alkalis; 1/2 inch length.

2.05 FIELD MEASUREMENTS

- A. Field verify dimensions prior to fabrication.

2.06 FABRICATION

- A. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.
 1. Maintain units within specified tolerances conforming to shape, lines and dimensions shown in approved design drawings.
- B. Maintain consistent quality during manufacture.
- C. All units to be fabricated straight, smooth, and true to size and shape prior to finishing. Exposed edges to be finished as per edge specifications. Maximum dimensional variations: +0", - 1/4" at maximum slab length; typical variations are usually half of the maximum or less.
- D. All units to be hand finished prior to sealing. Hand finishing includes first grinding the surface, then filling voids and honeycomb with colored grout, easing all edges (where appropriate), and leveling and polishing.
- E. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

- F. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

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 INSTALLATION

- A. Install in accordance with manufacturers written installation instructions.

3.04 REPAIR

- A. Repair exposed exterior surface to match color and texture of surrounding concrete and to minimize shrinkage.
- B. Adhere large patch to hardened concrete with bonding agent.

3.05 CLEANING

- A. Clean panels after installation and joint treatment.
 - 1. Clean soiled precast concrete with detergent and water or as recommended by manufacturer.
- B. Use cleaning materials or processes which will not change character of exposed concrete finishes.
- C. Protect adjacent surfaces.
- D. Rinse thoroughly with clean water immediately after using cleaner.
- E. Protect work and materials of other trades.
- F. Protect architectural precast units from chipping, spalling, cracking or other damage.

END OF SECTION

SECTION 03 49 00
GLASS-FIBER REINFORCED CONCRETE (GFRC)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural precast glass-fiber-reinforced concrete wall panels.
- B. Supports, anchors, and attachments.

1.02 REFERENCE STANDARDS

- A. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- B. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- C. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- D. PCI MNL-128 - Recommended Practice for Glass Fiber Reinforced Concrete Panels 2001.

1.03 SUBMITTALS FOR REVIEW

- A. Product Data: Provide physical characteristics, product limitations, and as follows:mixing instructions
 - 1. Technical data to show compliance with specified requirements.
 - 2. Approval certificate by manufacturer for proposed Subcontractor.

1.04 DOCUMENTATION FOR ON-SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Documentation for On-Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for on-site information:
 - 1. Certificate: Certify that products meet or exceed specified requirements.
 - 2. Manufacturer's Instructions: Indicate mix instructions.
 - 3. Other types indicated.

1.05 DOCUMENTATION FOR ON-SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Documentation for On-Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for on-site information:
 - 1. Certificate: Certify that products meet or exceed specified requirements.
 - 2. Manufacturer's Instructions: Indicate mix instructions.
 - 3. Other types indicated.

1.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Operation and maintenance data.
 - 2. Submittals for On-Site information
 - 3. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle units to position, consistent with their shape and design. Lift and support only from support points.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. See Section 09 06 02 Materials and Finishes Schedule.

2.02 GLASS-FIBER-REINFORCED CONCRETE UNITS

- A. Glass-Fiber-Reinforced Concrete Units: Factory-fabricated, using rigid molds, constructed to maintain unit panel uniform in shape, size and finish.
 - 1. Design and fabricate to comply with applicable codes.
 - 2. Design to withstand dead loads, positive and negative wind loads, and erection forces.
 - 3. Control deflection of units to maintain fit with adjacent construction and openings within their tolerances.
 - 4. Design connections to accommodate building movement without damage to components, wracking of joint connections, breakage of seals, or moisture penetration.
 - 5. Allow for adjustment of connections to accommodate misalignment of structure without permanent distortion.
 - 6. Concrete Mix: Of strength to accommodate panel configuration, panel size and weight, and manufacturing criteria, air entrained.
 - 7. Welding: Comply with AWS D1.1/D1.1M.
 - 8. Appearance: Ensure exposed-to-view finish surfaces of units are uniform in color and appearance.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M Portland Type I - Normal; white color.
- B. Concrete Aggregates: ASTM C33/C33M.
- C. Reinforcement: Alkali resistant chopped glass fiber rovings specifically formulated for use in concrete, with lengths varying from 1-1/2 to 2 inches.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate installation with structural supports, backup, and opening framing, if any.
- B. Install units without damage to shape or finish. Replace or repair damaged panels.
- C. Install units level and plumb within allowable tolerances.

3.02 TOLERANCES

3.03 CLEANING

- A. Clean units according to manufacturer's written instructions.
 - 1. Remove dirt, stains, and residue.
 - 2. Protect adjacent materials during cleaning.

3.04 PROTECTION

- A. Protect installed units from damage.

END OF SECTION

**SECTION 03 54 00
CAST UNDERLAYMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid-applied self-leveling floor underlayment.
- B. Acoustical Isolation Mat.

1.02 REFERENCE STANDARDS

- A. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete 2020.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

1.03 SYSTEM DESCRIPTION

- A. Liquid applied, gypsum-based self-leveling floor underlayment over wood and acoustical isolation mat.

1.04 PERFORMANCE REQUIREMENTS

- A. Acoustical Attenuation:
 - 1. STC of 50-54 based on tests conducted in accordance with ASTM E90.
 - 2. IIC: 50+.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide physical characteristics, product limitations, and as follows:mixing instructions
 - 1. Technical data to show compliance with specified requirements.
 - 2. Approval certificate by manufacturer for proposed Subcontractor.
- C. Manufacturer's Instructions: Indicate mix instructions.
- D. Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Instructions.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience and certified by manufacturer.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for combustibility or flame spread requirements.
- B. Underlayment shall be a component of a fire-resistant rated assembly with a FM, UL or Warnock Hersey label.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Delivery in manufacturers original, undamaged packages with legible identifying labels intact or in acceptable bulk handling equipment.
- B. Store off ground and protect from damage.

1.09 FIELD CONDITIONS

- A. Do not install underlayment until floor penetrations and peripheral work are complete.
- B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gypsum Underlayment:
 - 1. Maxxon Corporation; Product Dura-Cap: www.maxxon.com.
 - 2. Hacker Industries, Inc; Firm-Fill 3010+: www.hackerindustries.com/#sle.
 - 3. USG; Levelrock 3500: www.usg.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Cast Underlayments, General:
 - 1. Comply with applicable code for combustibility or flame spread requirements.
- B. Gypsum-Based Underlayment: Gypsum based mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
 - 1. Compressive Strength: Minimum 3500 psi, tested per ASTM C472.
 - 2. Density: Maximum 115 lb/cu ft.
 - 3. Final Set Time: 1 to 2 hours, minimum.
 - 4. Thickness: 1 inch, minimum.
 - 5. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.
- C. Sand: Washed masonry, mortar or plaster sand, 1/16 inch maximum size.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.
- E. Primer: Manufacturer's recommended type.

- F. Metal Lath: Galvanize metal lath weight as required by manufacturer.
- G. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.
- H. Sound Control Mat: Sheet material, perimeter isolation strip, and tape; as recommended by the underlayment manufacturer.
- I. Sealer: As approved by manufacturer.

2.03 ACOUSTICAL ISOLATION MAT

- A. Manufacturer:
 - 1. Maxxon Corporation; Product Acousti-Mat II, 1/4" thick.
 - 2. Hacker: Product SCM-250, 1/4" thick.
 - 3. USG; Product: SRM (Sound Reduction Mat) - 25, 1/4" thick
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 MIXING

- A. Site mix materials in accordance with manufacturer's instructions.
- B. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.
 - 1. If substrate is inadequate in any way to receive self-leveling underlayment to form a complete, sound system, do not proceed and notify Architect immediately in writing.
- B. Verify wood substrate complies with APA maximum span/joist criteria with deflection limitation of L/360 for design loads.

3.02 PREPARATION

- A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- B. Vacuum and clean surfaces loose material, dust, oil, grease, paint water soluble material and other contaminants..
- C. Prime substrate in accordance with manufacturer's instructions. Allow to dry.
- D. Install sound control mat in accordance with manufacturer's instructions.
- E. Continue expansion joints in substrate through underlayment.
- F. Install isolation mat underlayment in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Start installation upon completion of gypsum board finish on walls and ceilings.
- B. Work to be scheduled to minimize possible damage during construction process.
- C. Install underlayment in accordance with manufacturer's instructions.
- D. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.

1. Construction Documents.
 2. Reviewed Shop Drawings.
 3. Requirements of governmental agencies having jurisdiction.
- E. Primer and Surface Conditioner:
1. Apply 2 coats of primer to substrate and let dry.
 2. Apply where underlayment exposed to traffic during construction.
- F. Mix and place so as to avoid material segregation.
- G. Anchor components firmly into position plumb, level and true for long life.
- H. Patching: In accordance to Manufacturers written instructions after completion of underlayment installation, make a thorough visual inspection of areas and locate shrinkage cracks and other cracks in floor fill surface.
1. Patch cracks with a compound approved by Manufacturer.
 2. Smooth patches to provide a finish surface acceptable for applied finish floor.

3.04 CURING

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.
- C. Sealer:
 1. Apply where underlayment is to receive glued-down finish surface.

3.05 CLEANING

- A. Clean, without damaging, exposed surfaces of Work of this Section and repair where damaged. Remove refuse from site.
- B. Do not impose point loading on underlayment at any location; distribute loads on floor fill to prevent damage to finish surface until floor finishes are applied.

3.06 PROTECTION

- A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
- B. Protect work of others from damage.
- C. Do not permit traffic over unprotected floor underlayment surfaces.
 1. Provide adequate protection until fill has attained sufficient strength to withstand damage from imposed loads.
 2. Do not impose point loading on underlayment at any location; distribute loads on floor fill to prevent damage to finish surface until floor finishes are applied.

END OF SECTION

**SECTION 05 12 00
STRUCTURAL STEEL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members, support members.
- B. Base plates, shear stud connectors.
- C. Grouting under base plates.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- C. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.
- D. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel 2013 (Reapproved 2018).
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- G. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding 2022.
- H. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality 2019.
- I. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.
- J. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2021a.
- K. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel 2021, with Editorial Revision.
- L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2022.
- M. 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.
- N. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- O. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.
- P. ASTM F436 - Standard Specification for Hardened Steel Washers 2011.

- Q. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2020.
- R. 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.
- S. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- T. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- U. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2020.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- 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. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE

- A. Provide Preinstallation Meeting: See, Section 01 30 00 Administrative Requirements.
 - 1. Meeting to occur two weeks prior to issuing either concrete embed shop drawings or structural steel shop drawings, whichever starts first.
 - 2. Items for discussion: Steel knife plates and other steel detailing elements intersecting enclosure waterproofing.
 - a. Base plates extending beyond ends of knife plates in every direction of elevations.
 - b. Knife plates 90 degrees from waterproofing for 4 inches minimum.
 - c. Knife plates vertically oriented.

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. Steel Shapes, Plates, and Bars: ASTM A242/A242M high-strength, corrosion-resistant structural steel.
- E. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.
- F. Steel Plates and Bars: ASTM A572/A572M, Grade 50 (345) high-strength, columbium-vanadium steel.
- G. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- H. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.
- I. Steel Bars: ASTM A108.
- J. Steel Plate: ASTM A514/A514M.
- K. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.
- L. Pipe: ASTM A53/A53M, Grade B, Finish black.
- M. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.
- N. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
- O. Headed Anchor Rods: ASTM F1554 Grade 36, zinc-coated.
- P. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- Q. 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.
- R. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- S. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Fabricate connections for bolt, nut, and washer connectors.
- D. Develop required camber for members.

2.03 FINISH

- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.
 - 1. Interior steel to have manufacturer standard primer.
 - 2. Exterior steel and interior steel with exterior exposed components to have high performance primer.
- B. High Performance Prime Painting: One coat.

1. Shop Primer for Exterior Steel
 - a. Surface Preparation: SSPC-SP 6 with 1-3 mil surface profile and SSPC-SP 3 for touch up.
 - b. Primer: Zinc-rich primer.
 - 1) Rodda: Carboline Carbozinc 859 3-5mils DFT.
 - 2) Sherwin-Williams: Zinc Clad III HS-100, B69-100 Series.
2. Touch up Primer, Intermediate and Finish Coats per Section 09 91 13 Exterior Painting and 09 91 23 Interior Painting.
3. Substitutions: Not permitted.

2.04 SOURCE QUALITY CONTROL

- A. Provide shop testing and analysis of structural steel.
- B. Welded Connections: Visually inspect all shop-welded connections.

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 S303.
- 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. 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".
- E. Do not field cut or alter structural members without approval of Architect.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

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 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. After completing installation, remove and recycle debris, excess materials and debris from project site per Section 01 74 19.

3.05 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts," testing at least 25 percent of bolts at each connection.
- C. Welded Connections: Visually inspect all shop-welded connections.

END OF SECTION

SECTION 05 12 13
ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING (AESS)

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel: General requirements for structural steel members, including AESS framing specified in this section.
- B. Section 09 91 13 - Exterior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.
- C. Section 09 91 23 - Interior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.
- D. Section 09 96 00 - High-Performance Coatings: Finish coat requirements and coordination with primer and surface preparation specified in this section.

1.03 REFERENCE STANDARDS

- A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2022.
- B. AISC 360 - Specification for Structural Steel Buildings 2022.
- C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2022.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- E. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS) 2015.
- F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- H. SSPC-SP 3 - Power Tool Cleaning 2018.
- I. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting at project site one week prior to start of work of this section; require attendance by all affected installers. Coordinate requirements for shipping, special handling, storage, attachment of safety cables and temporary erection bracing, final coating, touch-up painting, mock-up coordination, Architect's observations, and other requirements for AESS.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product data for each type of product specified. Submit paint systems in accordance with Section 09 91 13.
- C. Shop Drawings: Detailing for fabrication of AESS components.
 - 1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
 - 2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.
 - 3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.
 - 4. Indicate orientation of hollow structural section (HSS) seams and mill marks (where applicable).
 - 5. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections. Indicate orientation of bolt heads.
 - 6. Indicate which surfaces or edges are exposed and what class of surface preparation is being used.
- D. AESS 1, AESS 2, AESS 3, and AESS 4 Samples: Provide samples of specific AESS characteristics. Samples may be small size samples or components of conventional structural steel demonstrating specific AESS characteristics, including surface preparation, sharp edges ground smooth, continuous weld appearance, weld show through, and fabrication mark removal.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: In addition to those qualifications listed in Section 05 12 00, engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the work.
- B. Comply with applicable provisions of AISC 303, Section 10 for the designated AESS category.

1.07 MOCK-UP

- A. Provide mock-ups for AESS 3, AESS 4, and AESS C of nature and extent indicated in Contract Documents.
- B. Locate mock-ups in fabricator's shop. Mock-ups to be full-size unless Architect approves smaller models. Alternatively, when a mock-up is not practical, the first piece of an element or connection can be used to determine acceptability.
- C. Notify Architect one week in advance of dates and times when mock-ups will be available for review.
- D. Demonstrate applicable AESS characteristics for specified category of AESS on elements and joints in mock-up.

- E. Mock-up to demonstrate weld quality, contouring of welds at aligned walls of members, specified surface preparation, and finish coating.
- F. Obtain Architect's written approval of mock-ups before starting fabrication.
- G. Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging completed work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Comply with Section 05 12 00, except as amended in this section for aesthetic purposes.
- B. Comply with AISC 303, Section 10 for specific AESS category designated on drawings.

2.02 FABRICATION

- A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.
- B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.
- C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.
- D. Bolted Connections:
 - 1. Make in accordance with Section 05 12 00. Provide bolt type and finish as noted herein.
- E. Welded Connections:
 - 1. Comply with AWS D1.1/D1.1M and Section 05 12 00.
 - 2. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerances of this section.
- F. Surface Preparation:
 - 1. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
- G. Fabricate AESS in accordance with categories defined in AISC 303, as follows:
 - 1. AESS 1: Basic elements.
 - 2. AESS 2: Feature elements viewed at a distance greater than 20 feet (feature elements not in close view).

2.03 PAINT SYSTEM

- A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 09 91 13. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.
- B. Finish Coating: Field apply intermediate and top coats per Sections 09 91 13, 09 91 23, and 09 96 00.

2.04 SHOP PRIMING

- A. High Performance Prime Painting: One coat.
 - 1. Shop Primer for Exterior Steel.
 - a. Surface Preparation: SSPC-SP 6 with 1-3 mil surface profile and SSPC-SP 3 for touch up.
 - b. Primer: Zinc-rich primer, Carboline Carbozinc 859 3-5 mils DFT.
 - c. Sherwin-Williams: Zinc Clad III HS-100, B69-100 Series.
 - 2. Touch up Primer, Intermediate and finish Coats per Section 09 91 13 Exterior Painting.
 - 3. Substitutions: Not permitted.
- B. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

2.05 MATERIALS

- A. General: Meet requirements of 05 12 00 as amended below.

2.06 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Structural Requirements:
 - 1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 05 12 00 for additional requirements.
- C. AESS 1 and 2 Acceptance: Architect to observe AESS in the shop at a viewing distance consistent with final installation and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with

fabricator prior to erecting steel.

3.02 PREPARATION

- A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.
- B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.03 ERECTION

- A. AESS 1 and 2: Basic elements; feature elements not in close view:
 - 1. Employ special care to handle and erect AESS. Erect finished pieces using nylon straps or chains with softeners such that they are not damaged.
 - 2. Place weld tabs for temporary bracing and safety cabling at points concealed from view in completed structure or where approved by Architect during pre-installation meeting. Obtain Architect approval of methods for removing temporary devices and finishing AESS members prior to erection.
 - 3. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of AISC 303.
 - 4. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
 - 5. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
 - 6. Remove all backing and run out tabs.
 - 7. When temporary braces or fixtures are required to facilitate erection, take care to avoid any blemishes, holes or unsightly surfaces resulting from use or removal of such temporary elements.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Structural Requirements:
 - 1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 05 12 00 for additional requirements.
 - 2. Quality assurance agency to review work for compliance with requirements of AISC 360, Chapter N and AISC 303, Section 10.
- C. AESS 1 and 2 Acceptance: Architect to observe AESS in place and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.
- D. Refer to Section 05 12 00 - Structural Steel for detailed bolt and weld testing requirements.

3.05 CLEANING

- A. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 09 91 13, 09 91 23, and 09 96 00.

END OF SECTION

**SECTION 05 40 00
COLD-FORMED METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall and interior wall framing.

1.02 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2020).
- 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 B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- E. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members 2018, with Editorial Revision.
- F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2020.
- G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on standard framing members; describe materials and finish, product criteria, limitations.
 - 2. Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements and indicating special procedures and conditions requiring special attention.
- C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud, floor joist, ceiling joist, and roof joist layout.
 - 2. Indicate cladding furring support layout.
 - 3. Describe method for securing studs to tracks and for bolted framing connections.
 - 4. Design data:
 - a. Shop drawings signed and sealed by a professional structural engineer.
 - 5. Calculations for loadings and stresses of specially fabricated framing, signed and sealed by a professional structural engineer.
 - 6. Details and calculations for factory-made framing connectors, signed and sealed by a professional structural engineer.
- D. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

- E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .
- F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before the start of scheduled welding work.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: Design framing system 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 Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
 - 1. Member of Steel Stud Manufacturers Association (SSMA).
 - 2. SSMA Certification Label: Provide label that manufacturing facilities satisfy the SSMA program certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 - 1. CEMCO: www.cemcosteel.com/#sle.
 - 2. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 3. Cemco; www.cemcosteel.com.
 - 4. Marino: www.marinoware.com.
 - 5. Scafco Steel Stud Manufacturing Co.: www.scafco.com.
 - 6. Steeler, Inc.; www.steeler.com.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Framing Connectors and Accessories:
 - 1. Same manufacturer as metal framing.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Design Requirements: Provide completed framing system having the following characteristics:
 - 1. Design: Calculate structural characteristics of cold-formed steel framing members and connectors according to AISI S100.
 - 2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
 - 3. Design Loads: In accordance with applicable codes.
 - 4. Live load deflection meeting the following, unless otherwise indicated:
 - a. Floors: Maximum vertical deflection under live load of 1/480 of span.
 - b. Roofs: Maximum vertical deflection under live load of 1/360 of span.
 - c. Exterior Walls: Maximum horizontal deflection under wind load of 1/360 of span.
 - d. Design non-axial loadbearing framing to accommodate not less than 1/2 in vertical deflection.

5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- C. Shop fabricate framing system to the greatest extent possible.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
1. Gauge and Depth: As required to meet specified performance levels.
 2. Stud Depth: As indicated on drawings.
 3. Finish Coating:
 - a. Galvalume, 55 AL-ZN, AZ55 coating.
 - b. Galvanized in accordance with ASTM A653/A653M with minimum G90/Z275 hot-dipped galvanized coating.
 4. Provide unpunched studs around exterior openings for doors, windows and other openings.
- B. Framing Connectors: Factory-made, formed steel sheet.
1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gauge, 0.1345 inch, and factory punched holes and slots.
 2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
 3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.
- C. Provide fasteners with corrosion resistance rating of 800 hours salt spray resistance per ASTM B117.
1. Application: Fasteners within building envelope.
 2. Finish: Manufacturers standard coating meeting requirements.
 3. Manufacturers:
 - a. Dril-Flex Structural Fasteners by Elco Construction Products.
 - b. Kwik-Flex Self-Drilling Fasteners by Hilti, Inc.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Provide fasteners outside building envelope to meet corrosion resistance rating of 2000 hours salt spray resistance per ASTM B117.
1. Application: Fasteners outside building envelope.

2. Manufacturers:
 - a. Elco Construction Products;; Stalgard coated Drix-Flex Fasteners:
www.elcoconstruction.com.
 - b. Substitutions: Not permitted.

2.05 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with ASTM C1007 requirements and ASTM C1007 requirements.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch.
- B. Maximum Variation of any Member from Plane: 1/4 inch.

3.04 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. After completing installation, remove and recycle debris, excess materials and debris from project site per Section 01 74 19.

END OF SECTION

**SECTION 05 40 10
COLD-FORMED FURRING ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Delegated-design Load-bearing cold-formed steel furring assembly for exterior wall and roof cladding systems, including fasteners.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2022.
- C. 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.
- D. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating 2011 (Reapproved 2021).
- E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2020.
- F. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.03 SYSTEM DESCRIPTION

- A. Size components to withstand design loads as follows: As indicated on structural drawings.
- B. Horizontal and Vertical Deflection: Deflection per Code or manufacturer's tolerance whichever is more stringent.
- C. Design ceiling/soffit system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
- D. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
- E. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- F. Provide load-bearing cold-formed steel furring assemblies as indicated on Drawings.
- G. Install system to accommodate:
 - 1. Construction tolerances.
 - 2. Deflection of building structural members.
 - 3. Clearances of intended openings.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on factory-made furring, connectors and clips, showing compliance with requirements and indicating special procedures and conditions requiring special attention.
- C. Shop Drawings: Indicate component details, framed openings, anchorage, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud and furring layout.
 - 2. Size, gauge, finish of furring, anchors and clips.
 - 3. Describe method for securing furring to tracks and studs framing.
 - 4. Details at mechanical fasteners.
 - 5. Provide calculations for loadings and stresses of specially fabricated furring that have been stamped by a Professional Structural Engineer.
 - 6. Provide details and calculations for framing connectors and fasteners, stamped by a Professional Structural Engineer.
 - 7. Installation sequence.
- D. Manufacturer's Installation Instructions: Including special procedures, conditions requiring special attention .

1.05 MOCK-UP

- A. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish.
 - 1. Provide products, including type, size, quantity of fasteners, and installation details, that are identical to each other.
- B. Mock-Up Size: As indicated on drawings.
- C. Location: As indicated on drawings.
- D. Mock-up may remain as part of Work.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Metal Furring and Connectors:
 - 1. Dietrich Metal Framing: www.dietrichindustries.com.
 - 2. Marino-Ware: www.marinoware.com.
 - 3. MiTek Industries, Inc: www.mii.com.
 - 4. Scafco Steel Stud Manufacturing Co.: www.scafco.com
 - 5. Unimast, Inc.: www.unimast.com.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Vertical Furring:
 - 1. Gauge: As determined by delegated design engineer.

2. Depth: As indicated on drawings.
 3. Finish Coating:
 - a. Galvalume in accordance with ASTM A792/A792M with minimum 55 AL-ZN, AZ55 coating.
 - b. Galvanized in accordance with ASTM A653/A653M with minimum G185/Z550 hot-dipped galvanized coating.
 - c. Stainless Steel. Type 304.
 4. Provide components fabricated from ASTM A1008/A1008M, Designation SS Grade 33 or HSLA (high-strength low alloy) Grade 50.
- B. Horizontal Furring:
1. Gauge and Depth: As indicated on Drawings.
 2. Finish Coating:
 - a. Galvalume in accordance with ASTM A792/A792M with minimum 55 AL-ZN, AZ55 coating.
 - b. Galvanized in accordance with ASTM A653/A653M with minimum G185/Z550 hot-dipped galvanized coating.
 - c. Stainless Steel. Type 304.
 3. Provide components fabricated from ASTM A1008/A1008M, Designation SS Grade 33 or HSLA (high-strength low alloy) Grade 50.
- C. Thermal Spacer:
1. Material: 55 KSI steel.
 2. Thickness: 14 gauge, 0.0785.
 3. Dimensions: 2 inch system depth to 3 inch system depth.
 4. Spacing:
 - a. Horizontally: 16 inches on center.
 - b. Vertically: Per Design Build requirements.
 5. Shim Material: Plastic composite, 82 percent thermally effective per procedures of ASHRAE 1365-RP and the Building Envelope Thermal Bridging Guide (BETB).
 6. Fasteners: 1/4-145 Tek Screws from clip to stud wall.
 7. Coating; G185 galvanized.
 8. Manufacturer:
 - a. Basis of Design: Foriea Clip; www.foriea.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

- A. Touch-up Primer for Galvanized Surfaces: SSPC-Paint 20, Type 1-Inorganic or SSPC-Paint 20, Type II Organic, complying with VOC limitations of authorities having jurisdiction.
- B. Insect Baffle:
 1. 20 pours per inch filter foam, adhesive one side, continuous.
 2. Compressible Open Cell Baffle.
 3. Color: Black.
 4. Manufacturer:
 - a. Lamatek: www.lamatek.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 FASTENERS

- A. Self-Drilling Self-Tapping Screws, Bolts, Nuts and Washers:
 - 1. Provide fasteners exterior to or penetrating, self-adhered membrane and sheathing with corrosion resistance rating of 2000 hours salt spray resistance per ASTM B177/B177M, minimum.
 - 2. Finish Basis-of-Design, fasteners at exterior furring assemblies:
 - a. Elco Construction Products;; Stalgard coated Dril-Flex Fasteners: www.elcoconstruction.com.
 - b. Substitutions: Not permitted.
- B. Z-girts at Concrete Substrate:
 - 1. Hex-head screws complete with washers. Concrete substrate requires predrilling for screw placement.
 - 2. Finish Basis-of-Design, fasteners at exterior furring assemblies:
 - a. Elco Construction Products;; Stalgard coated Dril-Flex Fasteners: www.elcoconstruction.com.
 - b. Substitutions: Not permitted.
- C. Z-girts to Steel Substrate:
 - 1. Fasteners: Self-drilling screws with quadrex pancake head. Corrosion resistance capable of salt spray testing per ASTM B177/B177M; 2,000 hours red rust, and 30 cycles Kesternich SO₂.
 - a. Elco Construction Products;; Stalgard coated Dril-Flex Fasteners- #10 x 1-1/2 inches: www.elcoconstruction.com.
 - b. Substitutions: Not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building framing components and sheathing assembly are ready to receive work.
- B. Do not proceed with installation of cold-formed furring assembly until cold-formed framing substrate assemblies are acceptable to Installer, and ensure installation of furring assembly and related wall claddings within erection tolerances specified.

3.02 INSTALLATION OF FURRING ASSEMBLIES

- A. Install components in accordance with Drawings and ASTM C1007 requirements.
- B. Sub-framing Thermal Spacer Installation: Install thermal spacers in accordance with spacer manufacturer's written recommendations.
- C. Connect furring clips through sheathing assembly to studs using self-drilling fasteners specified at on center dimension indicated.
- D. Install plastic wedge retainers in accordance with manufacturer's written instructions to retain board insulation.
- E. Install insert baffle cut to size, 1 inch by twice gap width.
- F. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 ERECTION TOLERANCES

- A. Maximum Variation from True Position: 1/16-inch.
- B. Maximum Variation of any Member from Plane: 1/16-inch.

3.04 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. After completing installation, remove and recycle debris, excess materials and debris from project site per Section 01 74 19.

END OF SECTION

**SECTION 05 50 00
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items.

1.02 REFERENCE STANDARDS

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- 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 A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.
- L. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- M. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata (2020).
- N. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- O. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- P. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.
- Q. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.
- R. SSPC-SP 3 - Power Tool Cleaning 2018.
- S. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. 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. Include the design engineer's stamp or seal on each sheet of shop drawings.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- D. Delegated Design Data: As required by authorities having jurisdiction.

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.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 BALCONY MOCK-UP

- A. Provide one assembled deck installed.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.06 QUALITY ASSURANCE

- A. Design systems 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. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.
- D. Field Measurements: Verify actual locations of walls and other construction contiguous with balconies by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

1. Bolts, Nuts, Screws, Nails and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M where connecting galvanized components, G185 coating.
2. Concrete Anchors:
 - a. Kwik-Bolt or Sleeve Anchor by Hilti, Inc.
 - b. Red Head Wedge Anchors by ITW Red Head.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
3. Masonry Anchors:
 - a. Sleeve Anchor by Hilti, Inc.
 - b. Red Head Wedge Anchors by ITW Red Head.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
4. Epoxy Adhesive for Drilled Anchors:
 - a. HJV by Hilti, Inc.
 - b. ET Epoxy-Tie Anchoring Adhesive by Simpson Strong-Tie Co.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Anchorage to Substrate: Screws, bolts, adhesive and other metal supports, of type and size to suit application; to rigidly secure materials in place.
 1. Fasteners: To meet Building Code requirements:
 - a. Expansion Bolts: ICC-ES AC193.
 - b. Screws: ICC-ES AC193.
 - c. Adhesive: ICC-ES AC308.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
- C. Bolts, Nuts, and Washers: Stainless steel.
- D. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 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. Fabricate components according to AWS specifications and industry standard practices. Ensure components include necessary attachment plates, drilled holes, and hardware required for assembly and installation.
- 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. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

- A. Ladders: Steel; in compliance with ANSI A14.3 and OSHA regulations; with mounting brackets and attachments; prime paint finish.
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. Width: 36 inches minimum.
 5. Design Requirements:
 - a. Regulatory Requirements: Provide ladders and enclosures complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
 - b. Design and fabricate ladder to support a concentrated load of 500 lb with deflection of stringer or landing framing not to exceed 1/240 of span.
- B. Bolt-on Balcony: As detailed; steel, High performance paint frame per Section 09 91 13, Exterior Painting.
1. Basis of Design: As detailed, weld joints to be grind smooth and filled.
 2. Bolt-on Balcony system:
 - a. Finish: High performance paint frame per Section 09 91 13, Exterior Painting.
 - b. Railings: See Section 05 73 00.
 3. Structural Performance:
 - a. Balcony Platform:
 - 1) Uniform live load of 40 lbf/sq. ft.
 - b. Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1) Uniform load of 50 lbf/ft. applied in any direction.
 - 2) Concentrated load of 200 lbf applied in any direction.
 - 3) Uniform and concentrated loads need not be assumed to act concurrently.
 - c. Railing Infill:
 - 1) Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - 2) Infill load and other loads need not be assumed to act concurrently.
 4. Shop Finish: High performance paint primer and finish coats.
 5. Framing and pickets: As detailed.
- C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- D. Ledger Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; galvanized finish.
- E. Structural Embeds: As detailed; prime paint finish.
- F. Corner Guards: As detailed, 3 x 3 angle attached to exposed concrete columns in garage; galvanized finish, epoxy adhesive set.

- G. Elevator Pit Grate: Galvanized steel grating with integral flange and support angles.
 - 1. Size: 18 inches by 18 inches, unless noted otherwise on drawings or by Code.

2.05 FINISHES - STEEL

- A. High Performance Prime Painting: One coat.
 - 1. Shop Primer for Exterior Steel:
 - a. Surface Preparation: SSPC-SP 6 with 1-3 mil surface profile and SSPC-SP 3 for touch up.
 - b. Primer: Zinc-rich primer.
 - 1) Sherwin Williams: Zinc Clad IV.
 - 2) Carboline: CarboZinc 859 VOC, 3-5mils DFT.
 - 2. Touch up Primer, Intermediate and finish Coats per Section 09 91 13 , Exterior Painting.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Shop Primer for Interior Steel:
 - 1. Surface Preparation: SSPC-SP 6.
 - 2. Primer: Rust inhibitor.
 - a. Sherwin Williams: Steel Spec Universal Primer.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

2.06 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Examine attachment locations for suitable conditions where balconies will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

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 items plumb and level, accurately fitted, free from distortion or defects.
- B. Comply with manufacturer's standards and engineering for installation of balconies.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Field weld components as indicated on drawings.
- E. Perform field welding in accordance with AWS D1.1/D1.1M.
- F. Obtain approval prior to site cutting or making adjustments not scheduled.
- G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

3.05 CLEANING

- A. Remove site cuttings from finish surfaces.

END OF SECTION

**SECTION 05 52 13
PIPE AND TUBE RAILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Custom fabricated exterior steel rails and handrails.
- C. Stair railings and guardrails.

1.02 REFERENCE STANDARDS

- A. AA DAF-45 - Designation System for Aluminum Finishes 2003 (Reaffirmed 2009).
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A29/A29M - Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought 2020.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- F. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2022.
- G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- I. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.
- J. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings 2018, with Editorial Revision.
- K. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- L. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2012.
- M. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.
- N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- O. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2022.
- P. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings 2020.

- Q. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications 2021.
- R. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- S. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).
- T. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals 2016.
- U. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- V. SSPC-SP 7 - Brush-Off Blast Cleaning 2007.

1.03 PERFORMANCE REQUIREMENTS

- A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials.
- B. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:
 - 1. Top Rail of Guards: Capable of withstanding following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 2. Handrails Not Serving As Top Rails: Capable of withstanding following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 50 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
 - a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For manufacturer's product lines of handrails and railings assembled from standard components.
 - 1. Include Product Data for grout, anchoring cement, and paint products.
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.05 STORAGE

- A. Store handrails and railings in a dry, well-ventilated, weathertight place.

1.06 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Drawings.

1.07 SCHEDULING

- A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that do not satisfy structural performance requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Exterior Aluminum Railing System:
 1. Hansen Architectural Systems; Product: Modified Series 300 with two horizontal 1 inch by 1/8 inch aluminum bars across vertical pickets.

2.02 RAILINGS - GENERAL REQUIREMENTS

- A. Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.
- B. Allow for expansion and contraction of members and building movement without damage to connections or members.
- C. Dimensions: See drawings for configurations and heights.
- D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- E. 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.

2.03 ALUMINUM MATERIALS

- A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- C. Extruded Bar and Tube: ASTM B221, alloy 6063-T5.
- D. Drawn Seamless Tube: ASTM B210, alloy 6063-T832.
- E. Solid Bars and Flats: ASTM B211/B211M.
- F. Plate and Sheet: ASTM B209, alloy 6061-T6.

- G. Die and Hand Forgings: ASTM B247, alloy 6061-T6.
- H. Castings: ASTM B26/B26M, alloy A356-T6
- I. Non-Weld Mechanical Fittings: Slip-on cast aluminum, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- J. Exposed Fasteners: No exposed bolts or screws.

2.04 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Rails and Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- C. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- D. Iron Castings: Malleable iron complying with ASTM A47/A47M, Grade 32510.
- E. Iron Castings: Gray iron complying with ASTM A48/A48M, Class 30.

2.05 ACCESSORIES

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
 - 1. Provide formed or cast brackets with predrilled holes.
 - 2. Finish: Bronze
 - 3. Fasteners: Concealed, unless noted otherwise.
- B. Wood Components: Maple species in profile selected, as specified in Section 06 40 00
 - 1. Provide at interior wood handrails, and at custom interior aluminum railing system.

2.06 FASTENERS

- A. Fasteners for Anchoring Handrails and Railings to Other Construction:
 - 1. Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
 - 2. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - 3. For aluminum handrails and railings, use fasteners fabricated from Type 304 or Type 316 stainless steel.
- B. Fasteners for Interconnecting Handrail and Railing Components:
 - 1. Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated.
 - 2. Do not use metals that are corrosive or incompatible with materials joined.
 - 3. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated
 - 4. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

2.07 PAINT

- A. Shop Primers: Provide primers complying with applicable requirements in Section 09 91 13 Exterior Painting and 09 91 23 Interior Painting.
- B. Bituminous Paint: Cold-applied asphalt mastic complying with ASTM D1187/D1187M and no asbestos fibers.

2.08 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.
 - 1. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
 - 1. Fabricate joints that will be exposed to weather in a watertight manner.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Close exposed ends of railing members with prefabricated end fittings.
 - 4. Provide weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.
 - 5. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- D. Form changes in direction of railing members as follows:
 - 1. By bending.
 - 2. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- E. Mechanical Connections:
 - 1. Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated.
 - 2. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 3. Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method
- F. Brackets, Flanges, Fittings, and Anchors:
 - 1. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction, as detailed.
- G. Shear and punch metals cleanly and accurately.
 - 1. Remove burrs from exposed cut edges.
- H. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.

- I. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
 - 1. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch or less.
- J. Fillers:
 - 1. Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
 - 2. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.09 STEEL AND IRON FINISHES

- A. Galvanized Handrails and Railings:
 - 1. Hot-dip galvanize exterior steel and iron handrails and railings to comply with ASTM A123/A123M.
 - 2. Hot-dip galvanize hardware for exterior steel and iron handrails and railings to comply with ASTM A153/A153M.
- B. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For ungalvanized steel handrails and railings, provide ungalvanized ferrous metal fittings, brackets, fasteners, and sleeves.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean handrails and railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- F. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed handrails and railings:
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."
- G. Apply shop primer to prepared surfaces of handrails and railings, unless otherwise indicated.
 - 1. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 2. Do not apply primer to galvanized surfaces.
 - 3. Stripe paint edges, corners, crevices, bolts, and welds.
- H. Painted Finish: As specified in 09 91 13 Exterior Painting and 09 91 23 Interior Painting.

2.10 ALUMINUM FINISHES

- A. Comply with AA DAF-45 for aluminum finishes required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Examine gypsum board assemblies, and other finish wall assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked

for Installer.

- C. Locate reinforcements and mark locations if not already done.

3.02 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.
 - 1. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
- C. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
- D. Anchor railings securely to structure.
 - 1. Adjust handrails and railings before anchoring to ensure alignment at abutting joints.
 - 2. Space posts at interval indicated, but not less than that required by structural loads.
- E. Fastening to In-Place Construction:
 - 1. Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.
- 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. Corrosion Protection: Coat concealed surfaces of aluminum alloys that will be contact with grout, concrete, wood, or dissimilar materials, with a heavy coat of bituminous paint.

3.03 RAILING CONNECTIONS

- A. Welded Connections:
 - 1. Use fully welded joints for permanently connecting railing components.
 - 2. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in shop or in field.
- B. Nonwelded Connections:
 - 1. Use mechanical or adhesive joints for permanently connecting railing components.
 - 2. Use wood blocks and padding to prevent damage to railing members and fittings.
 - 3. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

3.04 ANCHORING RAILINGS

- A. Anchor posts to floor type as required by conditions, bolted to supporting members.
 - 1. Use fittings designed and engineered for this purpose.
- B. Anchor rail ends to wall substrate as required sleeves or flanges connected to rail ends and anchored to supporting structure.

- C. Attach handrails to wall with wall brackets.
 - 1. Provide bracket with 1-1/2 inch clearance from inside face of handrail and finished wall surface.
 - 2. Locate brackets as indicated, or at spacing required to support structural loads if not indicated.
 - 3. For wood stud walls, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

3.05 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.

3.06 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- C. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
- D. After completing installation, remove and recycle debris, excess materials and debris from project site per Section 01 74 19.

3.07 PROTECTION

- A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer.
 - 1. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work.
 - 1. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

**SECTION 05 53 05
METAL GRATINGS AND FLOOR PLATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed metal floor gratings.
- B. Perimeter closure.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.
- C. NAAMM MBG 531 - Metal Bar Grating Manual 2017.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide span and deflection tables.
- C. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.
- D. Manufacturer's Installation Instructions: Indicate special requirements for opening and perimeter framing.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Load Design: NAAMM MBG 531.
- B. Maximum Allowable Deflection Under Live Load: 1/240 of span; size components by single support design.

2.02 MATERIALS

- A. Aluminum For Lock Forming: ASTM B211/B211M bars, shapes as indicated.

2.03 ACCESSORIES

- A. Fasteners and Saddle Clips: Galvanized steel:
- B. Perimeter Closure: Of same material as grating.

2.04 FABRICATION

- A. Fabricate grates to accommodate design loads.
- B. Mechanically clinch joints of intersecting metal sections.
- C. Fabricate support framing for openings with integral embeds in concrete.

- D. Top Surface: Non-slip.
- E. Bearing Bar: 1 by 1/8 inch size, spaced 1-3/16 inches on center.
- F. Cross Bar: 1 by 1/8 inch size, spaced 4 inches on center.

2.05 FINISHES

- A. Galvanizing for Steel Hardware: ASTM A153/A153M.
- B. Aluminum: Mill finish.
- C. Non-Slip Surfacing: Aluminum oxide.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes and dimensional tolerances are acceptable.
- B. Verify that supports are correctly positioned.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions.
- B. Place frames in correct position, plumb and level.
- C. Anchor by bolting through saddle clips.
- D. Set perimeter closure flush with top of grating and surrounding construction.
- E. Secure to prevent movement.

3.03 TOLERANCES

- A. Comply with NAAMM MBG 531.

**SECTION 05 73 00
DECORATIVE METAL RAILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-manufactured ornamental Aluminum exterior railing system.

1.02 REFERENCED STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members 2012.
- C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.
- D. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings 2018, with Editorial Revision.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- F. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2012.
- G. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.
- H. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- J. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2022.
- K. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings 2020.
- L. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2020.
- M. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications 2021.
- N. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- O. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.
- P. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).

- Q. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1 2016.
- R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.
- S. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- T. SSPC-SP 7 - Brush-Off Blast Cleaning 2007.

1.03 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. Scheduling: Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that do not satisfy structural performance requirements.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For manufacturer's product lines of handrails and railings assembled from standard components.
 - 1. Include Product Data for grout, anchoring cement, and paint products.
- C. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by qualified professional engineer responsible for their preparation.
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.
- E. Samples for Verification: Provide for each exposed finish surface the following:
 - 1. 6-inch long sections of each different linear railing member, including handrails, and top rails.
 - 2. Fitting and brackets,
 - 3. Assembled samples of railings, made from full-size components, including top rails, post, handrail and infill.
 - 4. Show method of finishing members at intersections.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum ___ years of experience.
- B. Perform design under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State in which the Project is located.

1.06 STORAGE

- A. Store handrails and railings in a dry, well-ventilated, weathertight place.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Exterior Aluminum Railing System:
 - 1. Hansen Architectural Systems; www.aluminumrailing.com.
 - 2. Sapa Profiles, Inc.; www.sapagroup.com/us.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials based on following:
 - 1. Cold-Formed Structural Steel: AISI S100-12.
- B. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:
 - 1. Top Rail of Guards: Capable of withstanding following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 2. Handrails Not Serving As Top Rails: Capable of withstanding following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
 - a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.
- C. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.03 RAILING SYSTEM

- A. Modified Series 300 with two horizontal 1 inch by 1/8 inch aluminum bars across vertical pickets by Hansen Architectural Systems.

2.04 MATERIALS

- A. Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

2.05 ALUMINUM MATERIALS

- A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- C. Extruded Bar and Tube: ASTM B221M, alloy 6063-T5.
- D. Drawn Seamless Tube: ASTM B210, alloy 6063-T832.
- E. Solid Bars and Flats: ASTM B211/ ASTM B211M.
- F. Plate and Sheet: ASTM B209, alloy 6061-T6.
- G. Die and Hand Forgings: ASTM B247, alloy 6061-T6.
- H. Castings: ASTM B26/B26M, alloy A356-T6.

2.06 FASTENERS

- A. Fasteners for Anchoring Handrails and Railings to Other Construction:
 - 1. Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
 - 2. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - 3. For aluminum handrails and railings, use fasteners fabricated from Type 304 or Type 316 stainless steel.
- B. Fasteners for Interconnecting Handrail and Railing Components:
 - 1. Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated.
 - 2. Do not use metals that are corrosive or incompatible with materials joined.
 - 3. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated
 - 4. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

2.07 GROUT AND ANCHORING CEMENT

- A. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days. Provide type recommended by Manufacturer for application.

2.08 FABRICATION

- A. Assemble handrails and railings in shop to greatest extent possible to minimize field splicing and assembly.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Clearly mark units for reassembly and coordinated installation.
 - 3. Use connections that maintain structural value of joined pieces.

- B. Form changes in direction of railing members by bending.
- C. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Welded Connections:
 - 1. Fabricate handrails and railings for connecting members by welding.
 - 2. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose.
 - 3. Weld connections continuously to comply with following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- E. Mechanical Connections: Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated.
 - 1. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 2. Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method.
- F. Brackets, Flanges, Fittings, and Anchors:
 - 1. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction, as detailed.
 - 2. Provide inserts and other anchorage devices to connect handrails and railing to concrete or masonry.
 - a. Fabricate anchorage devices capable of withstanding design loads.
- G. Shear and punch metals cleanly and accurately.
 - 1. Remove burrs from exposed cut edges.
- H. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.
- I. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- J. Provide weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.
- K. Fabricate joints that will be exposed to weather in a watertight manner.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
 - 1. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch or less.

- N. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.09 STEEL AND IRON FINISHES

- A. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. Galvanizing: In accordance with requirements of ASTM A123/A123M.
1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 15 Type I - Inorganic.
- C. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For ungalvanized steel handrails and railings, provide ungalvanized ferrous metal fittings, brackets, fasteners, and sleeves.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean handrails and railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- F. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed handrails and railings:
1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."
- G. Shop and Touch-Up Primer: SSPC-SP 7, complying with VOC limitations of authorities having jurisdiction.
1. Comply with requirements in SSPC V1 (PM1) for shop painting.
 2. Provide primers complying with applicable requirements in 09 91 13 Exterior Painting and 09 91 23 Interior Painting.
 3. Apply shop primer to prepared surfaces of handrails and railings, unless otherwise indicated.
 4. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 5. Do not apply primer to galvanized surfaces.
 6. Stripe paint edges, corners, crevices, bolts, and welds.
- H. Painted Finish:
1. As specified in Section 09 91 13 Exterior Painting and 09 91 23 Interior Painting.
 2. Bituminous Paint: Cold-applied asphalt mastic complying with ASTM D1187/D1187M and no asbestos fibers.

2.10 ALUMINUM FINISHES

- A. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as scheduled.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and other finish wall assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer.
- B. Locate reinforcements and mark locations if not already done.
- C. Verify that field measurements are as indicated on Drawings.

3.02 INSTALLATION, GENERAL

- A. Install glass, handrails and railings assemblies in accordance with manufacturer's written instructions.
- B. Fit exposed connections together to form tight, hairline joints.
- C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railings.
 - 1. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
 - 2. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 3. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 4. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- D. Adjust handrails and railings before anchoring to ensure alignment at abutting joints.
 - 1. Space posts at interval indicated, but not less than that required by structural loads.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum alloys that will be contact with grout, concrete, wood, or dissimilar materials, with a heavy coat of bituminous paint.

3.03 RAILING CONNECTIONS

- A. Welded Connections:
 - 1. Use fully welded joints for permanently connecting railing components.
 - 2. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in shop or in field.
- B. Nonwelded Connections:
 - 1. Use mechanical or adhesive joints for permanently connecting railing components.
 - 2. Use wood blocks and padding to prevent damage to railing members and fittings.
 - 3. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

3.04 ANCHORING RAILINGS

- A. Anchor posts to floor type as required by conditions, bolted to supporting members.

1. Use fittings designed and engineered for this purpose.
- B. Anchor rail ends to wall substrate as required sleeves or flanges connected to rail ends and anchored to supporting structure.
- C. Attach handrails to wall with wall brackets.
 1. Provide bracket with 1-1/2 inch clearance from inside face of handrail and finished wall surface.
 2. Locate brackets as indicated, or at spacing required to support structural loads if not indicated.
 3. For wood stud walls, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

3.05 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- C. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
- D. Remove site cuttings from finish surfaces.
- E. After completing installation, remove and recycle debris, excess materials and debris from project site per Section 01 74 19.

3.06 PROTECTION

- A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer.
 1. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work.
 1. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

**SECTION 06 10 00
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural dimension lumber framing.
- B. Rough opening framing for doors, windows, and roof openings.
- C. Wood Stairs
- D. Sheathing.
- E. Fire retardant treated wood materials.
- F. Miscellaneous framing and sheathing.
- G. Communications and electrical room mounting boards.
- H. Concealed wood blocking, nailers, and supports.
- I. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

- A. APA AFG-01 - Adhesives for Field-Gluing Plywood to Wood Framing; 1984.
- B. APA E30 - Engineered Wood Construction Guide 2019.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- G. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).
- H. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections; 2018.
- I. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).
- J. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing 2019a.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- L. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).
- M. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples 2021.

- N. AWWA U1 - Use Category System: User Specification for Treated Wood 2022.
- O. PLIB - Pacific Lumber Inspection Bureau.
- P. PS 1 - Structural Plywood 2019.
- Q. PS 2 - Performance Standard for Wood Structural Panels 2018.
- R. PS 20 - American Softwood Lumber Standard 2021.
- S. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2018.
- T. WWPA G-5 - Western Lumber Grading Rules 2021.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

- A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
 - 1. Acceptable Lumber Inspection Agencies: PLIB and WWPA.
 - 2. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
- C. Wood Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
 - 1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
 - 2. Structural Design: Provide complete stair and railing assemblies complying with the following:
 - a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
 - b. Railing Assemblies: Comply with ASTM E985.
 - 3. Dimensions: As indicated on drawings.
 - 4. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.

1.05 GRADE AND TREATMENT STAMPS

- A. Grade stamp each piece of framing lumber by grade stamp of American Lumber Standard Committee, Inc., Pacific Lumber Inspection Bureau, Western Wood Products Association.
- B. Identify each wood sheathing panel as to species, grade, span rating and glue type by stamp of APA - The Engineered Wood Association.

- C. Stamp each fire retardant treated wood piece, lumber and sheathing, with classification marking of UL, Timber Products Inspection, Inc., or other testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Do not overload, in place, floor or roof framing with temporarily stored materials.
- C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. 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.
- B. Engineered Wood Products:
 - 1. Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 2. Allowable Design Stresses:
 - a. Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated.
 - b. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Wood Stud Framing (2 by 2 through 2 by 6):
 - 1. Species: Douglas Fir-Larch.
 - 2. Grade: No. 2.
- E. Wood Joist, Rafter, Small Beam, and Stair Framing (2 by 6 through 4 by 16):
 - 1. Species and Grades: As indicated on drawings for various locations.

- F. Miscellaneous Wood Framing, Blocking, Nailers, Grounds, and Interior Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.
 - 3. Size: 2 by 8 unless otherwise noted.

2.03 CONSTRUCTION PANELS

- A. Subflooring: PS 2 type, rated Sheathing.
 - 1. Bond Classification: Exterior.
 - 2. Performance Category: See Structural General Notes.
- B. Roof Sheathing: APA Structural I Rated Sheathing, Exterior Exposure Class, as indicated on drawings and as follows:
 - 1. Thickness: As indicted on drawings.
 - 2. Oriented-strand-board not permitted.
 - 3. Provide tongue and groove edges.
- C. Wall Sheathing: PS 2 type.
 - 1. Bond Classification: Exterior.
 - 2. Grade: Structural I Sheathing.
 - 3. Span Rating: See Structural General Notes.
 - 4. Performance Category: See Structural General Notes.
 - 5. Edge Profile: Square edge.
- D. Marine Grade (MG) Plywood: PS 1 Type sheathing
 - 1. Bond classification: Exterior
 - 2. Grade: A-A
 - 3. Species: Group 1 Douglas-Fir
 - 4. Edges: Square
- E. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.
 - 2. Metal and Finish: Hot-dipped galvanized steel per ASTM A653/A653M, G185 for fire-treated and preservative-treated wood locations and G-185 Hot-dipped galvanized steel per ASTM A153/A153M for exterior or high humidity locations, unfinished steel elsewhere.
 - a. Size: Thickness and of sufficient length to penetrate studs a minimum 3/4 inch.
 - 3. Nails, Brads, and Staples: ASTM F1667.
 - 4. Bolts, Nuts, Washers, Lags, and Screws, Preservative-Treated Wood: Stainless steel; size and type to suit application.
 - 5. Bolts, Nuts, Washers, Lags, and Screws, Untreated Wood: Medium carbon steel; galvanized coating per ASTM A 153/A 153M; size and type to suit application.

- a. Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.
- 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.
 2. U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.
- C. Insect Screens
 1. Insect Screens: Woven aluminum mesh; 14/18 mesh size.
- D. Insect Baffle:
 1. Compressible Open Cell Baffle.
 2. Manufacturer:
 - a. Lamatek: Product; Sill Baffle; www.lametek.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Furring Strips:
 1. Material: Pressure treated, fire retardant treated Douglas Fir-Larch.
 - a. Grade: No. 2.
 2. Dimensions: 1 by 4 nominal.
 3. Application: Vertically to exterior wall weather barrier unless noted otherwise on drawings.
- F. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.
- G. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed; adhesives designed for subfloor applications and complying with either ASTM C557 or ASTM D3498.
 1. Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.
- H. Flashing: Stainless Steel as specified in Section 07 62 00.
- I. Drain Mat:
 1. Thickness: 0.40 inch.
 2. Product: Driwall Rainscreen 10 mm as manufactured by Keene Building Products; www.keenebuilding.com.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- J. Button Vents: 2 inch round, white plastic wall vent.
 1. Product: Model RLSC2 as manufactured by Master Flow.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- K. Soffit Vents: Aluminum Continuous Soffit vent; 2-3/4 inch wide.
 1. Color: White
 2. Free Area: 9 sq. in. per foot.
 3. Manufacturer: Air Vent Inc.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- L. Window Shims: 1/4 inch pressure treated plywood with nylon wedge shims.

2.05 FACTORY 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.
1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
1. Manufacturers:
 - a. Lonza Group: www.wolmanizedwood.com/#sle.
 - b. Hoover Treated Wood Products, Inc: www.frtw.com.
 - c. Koppers, Inc: www.koppersperformancechemicals.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Manufacturers:
 - 1) Hoover Treated Wood Products, Inc; Exterior Fire-X: www.frtw.com.
 - 2) Lonza Group; FRX: www.wolmanizedwood.com/#sle.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Prohibited Materials:
 - 1) Pentabrominated Diphenyl Ether, CAS # 32534-81-9.
 - 2) Octabrominated Diphenyl Ether, CAS # 32536-52-0.
 - 3) Decabrominated Diphenyl Ether, CAS # 1163-19-5.
 - c. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - d. Do not use treated wood in direct contact with the ground.
 3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Prohibited Materials:
 - 1) Pentabrominated Diphenyl Ether, CAS # 32534-81-9.
 - 2) Octabrominated Diphenyl Ether, CAS # 32536-52-0.
 - 3) Decabrominated Diphenyl Ether, CAS # 1163-19-5.
 - b. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - c. Treat rough carpentry items as indicated .

- d. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWWA Use Category UC3B, Commodity Specification A (Treatment C2) using SBX .
 - a. Borate Preservative Treatment: Disodium octoborate tetrahydrate (DOT) treatment for insect and decay protective pressure treatment of wood as produced by manufacturer's licensed treatment plants.
 - b. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - c. Treat interior lumber inside the weather barrier membrane.
 - d. Treat lumber furring.
 2. Preservative Pressure Treatment of Lumber Above Grade: AWWA Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative .
 - a. Meeting AWWA U1 requirements and acceptable to authorities having jurisdiction and one of the following:
 - 1) Copper Azole (CA-C).
 - 2) Ammoniacal, or amine, copper quat (ACQ).
 - b. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - 1) Including wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members.
 - d. Treat lumber in contact with masonry, concrete, or outside of weather barrier membrane.
 - 1) Including wood sills, sleepers, blocking, furring, stripping, and similar concealed members.
 - e. Treat lumber less than 18 inches above grade.
 - f. Treat items indicated on Drawings
 3. Preservative Pressure Treatment of Plywood Above Grade: AWWA Use Category UC2 and UC3B, Commodity Specification F (Treatment F9) using waterborne preservative.
 - a. Treat items indicated on Drawings for interior locations.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- 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. Install material in accordance with manufacturers instructions.
- B. Select material sizes to minimize waste.

- C. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- D. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
- E. Framing shall be dry with 19 percent maximum moisture content at time of covering.

3.03 FRAMING INSTALLATION

- A. 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.
- B. 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.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
 - 1. Provide minimum nominal 2 x 6 studs for wall studs over 12 feet of unsupported length.
 - 2. Install single bottom plates and double top plates, except where otherwise indicated.
 - 3. Overlap double top plates at corners, intersections, and running ends; stagger running ends 4 feet minimum. Locate ends over studs.
 - 4. Single top plates may be installed at interior nonload bearing walls and at window sills.
 - 5. Install sill plate seal under bottom plate.
 - 6. Install triple studs at corners and wall intersections.
 - 7. Install framing with 1/4 inch maximum deviation from indicated alignment.
- E. Framing with Engineered Wood Products:
 - 1. Install engineered wood products to comply with manufacturer's written instructions.
- F. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.
 - 1. Install framing with 1/4 inch maximum deviation from indicated alignment.
- G. 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.
- H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.
- I. Hang mechanical equipment, mechanical and sprinkler piping larger than 2 inch diameter, or other items producing hanger load over 50 lbs. by a system approved by Architect.
 - 1. Provide additional framing for any hanger producing a load over 200 lbs. to transfer loads to main structural beams or walls.
- J. Bearings:
 - 1. Provide full bearing, unless otherwise shown or indicated.
 - 2. Finish bearing surfaces for structural members to provide sure and even support.
 - 3. For sloping framing members, make minimum cuts or notches at ends as required to give uniform bearing surface.
- K. Installation of Steel Connectors for Wood Framing:

1. Install connectors, such as hangers, stirrups, anchors, straps, ties, bases and caps, with nails and bolts of largest sizes, types and amount specified by manufacturer of connector.
2. Provide "U" type hangers where joists, beams and girders frame into side of beams, ledgers and headers.
3. Provide post caps and bases at posts and columns.
4. Where model numbers for connectors are not indicated, provide type of connector designed to carry indicated dead loads plus snow and live loads.

3.04 FRAMING PENETRATIONS

- A. Studs may be notched in lower 1/5 of height of stud for electric and plumbing pipes, but no part of notch shall be deeper than 25 percent of depth of stud.
 1. Cover notches with metal plate, Simpson SS Stud Shoe, or approved.
- B. Holes of diameters up to 25 percent of stud may be drilled through center of studs, but not in middle 1/3 of stud height; cover face of stud with metal plate, Simpson SS Stud Shoe, or approved, where face is less than 2 inches from hole edge.
- C. Limit notches or drilled holes to maximum one per stud.
- D. Cutting, drilling or notching of beams and girders is not permitted.
- E. 2 x 6 joists and larger may have holes of 1 inch diameter maximum drilled in center 1/3 of their depth, center 1/3 of their span, at 24 inches o.c. minimum.

3.05 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 fireblocking 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 authorities having jurisdiction may be used in lieu of solid wood blocking.
 1. Install fire stop blocking in wood framed walls and partitions at each floor level and at ceiling line of top story.
 2. Install smoke stop blocking at combustible blind spaces exceeding 10 feet in any dimension, to create a barrier to passage of flame at 10 feet maximum intervals. Do same at furred spaces and utility chases.
 3. Install smoke stop blocking at double stud wood-framed walls and partitions at maximum intervals of 10 feet in any dimension.
 4. Install smoke stop blocking along and in line with run of each stairway in adjacent wood stud walls and partitions.
- 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 non-structural framing and blocking for support of items shown on the drawings and of the following items:
1. Cabinets and shelf supports.
 2. Wall mounted cabinets.
 3. Wall brackets.
 4. Handrails.
 5. Grab bars, for required and future grab bars.
 6. Towel and bath accessories.
 7. Wall-mounted door stops and hardware.
 8. Chalkboards and marker boards.
 9. Wall paneling and trim.
 10. Joints of rigid wall coverings that occur between studs.
 11. Plumbing fixtures.
 12. Toilet partitions.
 13. Wall mounted bike racks.
 14. Wall mounted mirrors.
 15. Window blinds, including roller shades.
- G. Bridging:
1. Install wood cross bridging, not less than 2 x 3 inch nominal, 16 gauge steel cross bridging of equal strength, or solid blocking between joists where span of joists exceeds 8 feet.
 2. Install bridging at a maximum distance of 8 feet between a line of bridging and a joist bearing.
 3. Do not anchor cross bridging until dead loads are in place. Space cross bridging members 1/4 inch minimum apart to avoid rubbing.

3.06 INSTALLATION OF CONSTRUCTION PANELS

- A. Comply with applicable recommendations contained in APA E30 for types of structural-use panels and applications indicated.
1. Space panels 1/8 inch apart at edges and 1/16 inch at ends.
- B. Subflooring: Glue and nail to framing; staples are not permitted.
- C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
1. Block panel edges with blocking.
- D. Fastening Methods: Fasten panels as indicated below:
1. Subflooring:
 - a. Glue and nail to wood framing.
 2. Wall, Roof, and Shear Panel Sheathing:
 - a. Provide minimum size, spacing and location per Building Code.
 - 1) Staples may be used in lieu of nails, providing a schedule is submitted to Architect for approval showing each nail size and spacing required and staple size and spacing proposed as substitute, accompanied with supporting test data.
 - b. Refer to Drawings for special nailing requirements.
 - c. Nail to wood framing.

- d. Space panels 1/8 inch apart at edges and ends.
- 3. Gypsum Sheathing:
 - a. Keep perimeter fasteners 3/8 inch from edges and ends of units.
 - b. Provide minimum nailing size and spacing in accordance with Building Code.
- 4. Plywood Backing Panels: Nail or screw to supports.
- 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.

3.07 STAIR FRAMING INSTALLATION

- A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:
 - 1. Notch stringers to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
 - 2. Stringer Spacing: At least 3 stringers for each 36-inch clear width of stair.

3.08 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment per AWPA M4, compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.09 TOLERANCES

- A. Framing Members: 1/8 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.

3.10 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. Tests of wood framing moisture content may be performed at any time and before finish cover to ensure conformance with specified requirements.
 - 1. Wood framing to be dry with 19 percent maximum moisture content .

3.11 CLEANING

- A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.

3. Do not burn scraps that have been pressure treated.
 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

**SECTION 06 15 00
WOOD DECKING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Softwood lumber structural wood decking.

1.02 REFERENCE STANDARDS

- A. AITC 111 - Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection 2005.
- B. AITC 112 - Standard for Tongue-and-Groove Heavy Timber Roof Decking 1993, with Errata (2003).
- C. SPIB (GR) - Standard Grading Rules 2021.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials.
- C. Shop Drawings: Indicate deck framing system, loads and cambers, bearing details, and framed openings.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect glue laminated members in accordance with AITC 111 requirements for unwrapped material.

PART 2 PRODUCTS

2.01 WOOD MATERIALS

- A. Wood fabricated from old growth timber is not permitted.
- B. Lumber Decking: Fabricated to AITC 112.
 - 1. Species: Douglas Fir, graded under SPIB (GR) rules as AITC Select quality.
 - 2. Size: 3X, nominal.
 - a. See Structural for 4X requirements.
 - 3. Pattern: AITC standard beveled V-joint with single tongue and groove.
 - 4. Face Surface: Smooth
 - 5. Moisture Content: 15 percent, maximum.

2.02 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Fastener Type and Finish: Hot-dipped galvanized steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Adhesive: Waterproof, air cure type, cartridge dispensed.

2.03 WOOD TREATMENT

- A. Penetrating Sealer: Clear sanding sealer, manufacturer standard compatible with finish specified in Section 09 06 02, Materials and Finishes Schedule and 09 91 13, Exterior Painting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that support framing is ready to receive decking.
- B. Verify wood framing is dry with 19 percent maximum moisture content at time of covering.

3.02 PREPARATION

- A. Coordinate placement of bearing items.

3.03 INSTALLATION - BOARD DECKING

- A. Install decking perpendicular to framing members, with ends staggered over firm bearing. On sloped surfaces, lay decking with tongue upward.
- B. Engage decking tongue and groove edges.
- C. Secure with fasteners. Side spike planks together, through pre-drilled holes.
- D. Diaphragm Design: Wood decking indicated to be of diaphragm design and construction to have adhesive that complies with research/evaluation report.
 - 1. Use adhesive that complies with VOC limits of South Coast Air Quality Management Distant Rule #1168.

3.04 TOLERANCES

- A. Surface Flatness of Decking Without Load: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

3.05 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 74 19.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.

END OF SECTION

**SECTION 06 16 53
MOISTURE RESISTANT SHEATHING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Moisture Resistant (M.R.) gypsum wall sheathing.
- B. High Temperature gypsum sheathing

1.02 REFERENCED STANDARDS

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- C. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on sheathing and installation instructions.
- C. Manufacturer's Certificate: Certify that products supplied meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

- A. Contractor to verify moisture resistant sheathing compatibility with applicable membranes adhered.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in manufacturer's original packaging, containers, and bundles with manufacturer's brand name and identification intact and legible.
- B. Store level and handle materials to protect against contact with damp and wet surfaces, exposed to weather, breakage, and damage to edges. Provide air circulation under covering and around stacks of materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Moisture Resistant (MR) Gypsum Sheathing: Glass Mat Faced Gypsum, ASTM C1177/C1177M, Type X fire-resistant core, long edges.
 - 1. Products:
 - a. Basis of Design: G-P Gypsum Corporation; Product Dens-Glass Fireguard: www.gp.com/gypsum.
 - 2. Thickness: 5/8 inch.
 - 3. Edges: Square.

4. Membrane Application Max Temperature: 125 F.
5. Fire Resistance:
 - a. Noncombustible when tested in accordance with ASTM E136.
 - b. One hour rated systems when tested in accordance with ASTM E119. UL Classified.
- B. High Temperature Gypsum Sheathing:
 1. Product:
 - a. Basis of Design: G-P Gypsum Corporation; Product DensDeck Prime with eonic technology: www.gp.com/gypsum.
 2. Application: Bottom 12 inches of walls above roofs with hot applied roof membranes and as indicated on drawings.
 3. Thickness: 5/8 inch.
 4. Edges: Square.
 5. Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 5/8 inch thick.
 6. Membrane Application Max Temperature: 450 F.

2.02 ACCESSORIES

- A. Construction adhesive/glue: Per Industry Standard for application.
- B. Fasteners and Anchors:
 1. Metal and Finish: Stainless steel, length as required to penetrate minimum 1-1/4 inch.
 - a. For high humidity (outside weather barrier or wet locations) and preservative-treated wood locations.
- C. Building Wrap Weather Barriers: See Section 07 25 05.
- D. Fluid-Applied Weather Barriers: See Section 07 25 07.
- E. Self-Adhered Membrane Flashing: See Section 07 25 11.
 1. Material is 0.040 inch thick minimum, 18 inches wide, composed of polyolefin film laminated to rubberized asphalt.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install per manufacturer's written installation instructions.
- B. Gaps: 1/4 inches maximum or no larger than applied membrane manufacturer's written installation instructions.
- C. High Temperature Gypsum Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
 1. Height: 18 inches above roofing.

3.02 FASTENING SCHEDULE

- A. Sheathing Fastening: Screw to steel studs and runners with bugle head screws spaced, sized, and located as required by Building Code.

3.03 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 74 19.

1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

END OF SECTION

SECTION 06 17 33
WOOD I-JOISTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood I-joists for floor framing.
- B. Bridging, bracing, and anchorage.

1.02 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 2 - Performance Standard for Wood Structural Panels 2018.

1.03 SUBMITTALS

- A. See Section 01 30 00 - 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.
 - 1. Stamped by a Professional Structural Engineer licensed in the State in which the Project is located
- D. Design Calculations: Stamped by a Professional Structural Engineer licensed in the State in which the Project is located
- E. Certificate: Certification by joist manufacturer that products delivered are of the same design and construction as those evaluated by the independent inspection agency.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code requirements for loads, seismic, and other governing criteria.

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. Fabricating plant approved by I.C.B.O. certified testing agency.
- B. Design joists and associated components under direct supervision of a Professional Structural Engineer experienced in design of this work and the State in which the Project is located
- C. Joist manufacturer to inspect joists after they have been erected, and sheathing, bridging, and blocking have been installed.
 - 1. Manufacturer to submit certificate to Architect that inspection was made and that joists are in acceptable condition and meet with manufacturer's design and installation requirements.

1.06 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated in Drawings and Shop Drawings.

1.07 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. Wood I-Joists:
 - 1. Louisiana-Pacific Corporation: www.lpcorp.com/#sle.
 - 2. Redbuilt Engineered Wood Products; www.redbuilt.com.
 - 3. Weyerhaeuser Company: www.weyerhaeuser.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - 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. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.
 - 4. 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.
 - 5. Marking: Mark each piece with depth, joist spacing, and allowable span for joist spacing.
- B. Wood-Based Components:
 - 1. Wood fabricated from old growth timber is not permitted.
- C. Joist Bridging: Type, size and spacing recommended by joist manufacturer.
- D. Adhesive: Manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that supports and openings are ready to receive joists.

- B. Verify wood framing is dry with 19 percent maximum moisture content at time of covering.

3.02 PREPARATION

- A. Coordinate placement of support 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.
 - 1. Design of temporary bracing and shoring is responsibility of Contractor
- D. Install permanent bridging and bracing.
- E. Install headers and supports to frame openings required.
- F. Coordinate installation of sheathing/decking with work of this section.

3.04 TOLERANCES

- A. Framing Members: 1/2 inch maximum, from true position.

3.05 FIELD QUALITY CONTROL

- A. Joist manufacturer to inspect joists after they have been erected, and sheathing, bridging, blocking, and like are in place.
- B. Joist manufacturer to submit certificate to Architect certifying that inspection was made and that joists are in acceptable condition and meet manufacturer's design and installation requirements.

END OF SECTION

SECTION 06 17 53
SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated wood trusses for roof framing.
- B. Bridging, bracing, and anchorage.

1.02 REFERENCE STANDARDS

- A. ANSI/TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction 2014.
- B. TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction 2014.
- C. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses 2018.
- D. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses 1989.
- E. Provide additional framing installed to transfer loads to main structural beams or wall for any hanger or support producing a load over 200 lbs., unless otherwise approved.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Test Data:
 - 1. Component of a fire-resistant rated ceiling assembly. Provide appropriate National Evaluation Service Committee Report of Council of American Building Officials.
 - a. Reference Report No., Manufacturer's name, plant number, independent inspection agency and evaluation report number.
- C. Complete calculations recording stresses involved, stamped by a Structural Engineer registered in the State in which the Project is located.
 - 1. Location of sprinkler line attachment and attachment of loads exceeding 100 lbs. shall be approved prior to truss installation.
- D. Manufacturer's certification that trusses have been installed in accordance with manufacturer's design and installation requirements.

1.04 QUALITY ASSURANCE

- A. Truss connector plates Manufacturer to be member of Truss Plate Institute.
- B. Each piece of wood shall be identified by grade stamp of West coast Lumber Inspection Bureau, Western Wood Products Association, or approved.
- C. Coordinate as required with other trades to assure proper and adequate provision for interfacing with work of this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle and erect trusses in accordance with TPI BCSI 1.
 - 1. Protect from damage, and deterioration due to effects of weather; store off ground in an upright position.
 - 2. Coordinate deliveries with erection sequence. Provide all temporary bearing, support and bracing to prevent bending and overturning.
- B. Store trusses in vertical position resting on bearing ends.
- C. Do not subject to loading that trusses are not designed to resist.
- D. Do not overload building's structure with trusses concentrated at certain locations.

PART 2 PRODUCTS

2.01 TRUSSES

- A. Wood Trusses: Designed and fabricated in accordance with ANSI/TPI 1 and TPI DSB-89 to achieve structural requirements indicated.

2.02 MATERIALS

- A. Lumber:
 - 1. Machine stress-rated: MSR lumber is acceptable, but not required.
 - 2. Moisture Content: Between 7 and 9 percent.
 - 3. Thickness: 1-1/2 inches minimum.
- B. Electrolytic Zinc Coated Steel Sheet: ASTM A 591, Coating Class C, with min. structural equality equivalent to ASTM A 653, Grade A.
- C. 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 10 00.
- B. Fasteners: Electrogalvanized steel, type to suit application.
- C. Bearing Plates: Electrogalvanized steel.

2.04 FABRICATION

- A. Size and detail Work to fit dimensions indicated on Drawings:
- B. Provide girder trusses where shown or required.
- C. Provide other materials required for a complete and proper installation:
 - 1. Bridging, bearing hardware including hurricane clips, blocking, hangers, shear panels, etc., that connect to trusses per approved details, in order to provide a complete structural system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that supports and openings are ready to receive trusses.
- B. Correct conditions detrimental to timely and proper completion of Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Protect work of others from damage
- E. Verify wood framing is dry with 19 percent maximum moisture content at time of covering.
- F. Install Work in accordance with:
 - 1. Construction Drawings
 - 2. Reviewed Shop Drawings
 - 3. Requirements of governmental agencies having jurisdiction.
 - 4. Manufacturer's and referenced standard's recommended installation procedures.

3.02 PREPARATION

- A. Coordinate placement of bearing items.
- B. Press-apply connector plates without splitting or fracturing wood.

3.03 ERECTION

- A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.
 - 1. Do not impose temporary construction loads which cause stresses beyond design limits:
 - 2. Brace during erection to prevent over-stressing members with temporary construction loads.
- B. Truss installer shall exercise extreme care during erection of trusses to prevent trusses from buckling laterally:
 - 1. Use spreader bars for lifting trusses and provide lateral bracing as necessary.
 - 2. Remove any damaged trusses from job; do not attempt to reinforce damaged trusses
- C. Set members level and plumb, in correct position.
- D. Install permanent bridging and bracing.
 - 1. Provide solid blocking at concentrated loads.
 - 2. Anchor blocking and stiffeners to maintain units rigid, straight and plumb
- E. Install on plates with full width bearing, or full depth of steel hangers; anchor as recommended by truss Manufacturer.
 - 1. At openings in roof wider than regular truss spacing, double trusses at each edge; provide double trusses elsewhere as shown:
 - 2. Unless otherwise noted, nail double trusses together from both sides with 2 rows of nails on each side at top and bottom chords spaced 12 inches on center maximum staggered, and with one row on each side at web members spaced 12 inches on center maximum.

3.04 FIELD QUALITY CONTROL

- A. Truss manufacturer to inspect trusses after they have been erected, and sheathing, bridging, blocking, and the like are in place.
- B. Truss manufacturer to submit certificate to Architect certifying that the inspection was made and that trusses are in acceptable condition and meet the manufacturer's design and installation requirements.

3.05 CLEANING AND CORRECTION OF DEFECTIVE WORK

- A. Remove and replace defective and damaged trusses, stiffeners, and blocking.
- B. Clean, without damaging, exposed surfaces affected by Work of this Section.
 - 1. Repair as necessary.
- C. Waste Disposal: Comply with the requirements of Section 01 7419.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

END OF SECTION

**SECTION 06 18 00
GLUED-LAMINATED CONSTRUCTION (G-LAM)**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glue laminated wood beams.
- B. Steel hardware and attachment brackets.

1.02 REFERENCED STANDARDS

- A. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber 2007.
- B. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2018.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.
- C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings .

1.04 QUALITY ASSURANCE

- A. 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.
- B. Erector Qualifications: Company specializing in erection of products of the type specified with 5 years documented experience, and approved by manufacturer.

1.05 QUALITY MARK

- A. Structural glued laminated timber shall be manufactured in accordance with ANSI/AITC A190.1.
- B. Each timber shall be accompanied with an AITC Certificate of Conformance and not be grade marked.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect members to AITC requirements for individually wrapped.
 - 1. Leave individual wrapping in place until finishing occurs.
- B. Schedule delivery and installation of glue-laminated wood members to avoid extended on-site storage. Comply with AITC 111 -"Recommended Practice for Protection of Structural Glued-Laminated Timber during Transit, Storage and Erection."
- C. Keep laminated wood members as dry as possible during all phases of construction.
 - 1. Water stains to be removed prior to application of any finish.
 - 2. Protect wood members from moisture to prevent mold and mildew.

- D. Jobsite storage: Place members on blocking away from ponding water and cover with a waterproof covering which will not allow ultraviolet ray penetration.
 - 1. Store members level on supports, at 10 feet on center or less. Minimum 6 inches above grade.
- E. Precautions to minimize checking:
 - 1. Cover all members with loosely fitting tarpaulin in addition to the factory wrapping.
 - 2. Once the structure is enclosed, building temperature to be increased over several days to reach the space design temperature.
 - 3. Dry weather conditions: Air to be humidified and maintained at a low temperature over several weeks to promote gradual drying.
 - 4. Installed members to be at 12 percent maximum moisture content.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glued-Laminated Structural Units:
 - 1. Sentinel Structures, Inc: www.sentinelstructures.com/#sle.
 - 2. Western Wood Structures, Inc: www.westernwoodstructures.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GLUED-LAMINATED UNITS

- A. Glued-Laminated Units: Fabricate in accordance with AITC 117 Architectural 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. After end trimming, seal with penetrating sealer in accordance with AITC requirements.
- B. Performance Criteria:
 - 1. Comply with applicable code for loads, seismic zoning, and other load criteria.

2.03 MATERIALS

- A. Lumber: Softwood lumber complying with WCLIB (GR) grading rules with 12 percent maximum moisture content before fabrication. Design for the following values:
 - 1. Combination Symbol: As indicated on structural drawings and, conforming to WWPA grading rules with 12 percent maximum moisture content before fabrication.

2.04 FABRICATION

- A. Fabricate glue laminated structural members in accordance with AITC Grade as follows:
 - 1. Special Appearance, complying with AITC 110 except as noted herein.
 - a. Special Appearance Grade: Comply with AITC 110, Premium Appearance Grade except as noted below.
 - 1) Filling of voids on edge of laminations: Not allowed.
 - 2) Laminations wide face exposed to view: Selected for appearance, Clear Vertical grain; free of loose knots, no filling allowed and knot size limited to 1-3/4"

maximum.

- 3) Edge joints on wide faces of laminations: Filled.
2. Surface Texture: Machine sanded.
- B. Field Finishing of Members: Specified in Section 09 91 13 and 09 91 23.

2.05 FINISH REQUIREMENTS

- A. Surface Sealer: Penetrating sealer shall be applied to all surfaces before shipment. Minimum two coats.
- B. After end trimming, seal with penetrating sealer in accordance with AITC requirements. Minimum two coats.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate placement of bearing items.

3.02 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.

3.03 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 74 19.
 1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

END OF SECTION

SECTION 06 40 13
WCLB AND WWPA EXTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Exterior standing and running trim.
- B. Shop priming of exterior woodwork.

1.02 REFERENCE STANDARDS

- A. ASME B18.6.1 - Wood Screws: 1981, Revised 2016.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. AWPA P5 - Standard for Waterborne Preservatives 2014.
- D. AWPA U1 - Use Category System: User Specification for Treated Wood 2022.
- E. PS 20 - American Softwood Lumber Standard 2021.
- F. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2018.
- G. WWPA G-5 - Western Lumber Grading Rules 2021.

1.03 DEFINITIONS

- A. Exterior architectural woodwork includes wood blocking, shims, and nailers for installing woodwork items unless concealed within other construction prior to woodwork installation.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
- C. Shop Drawings: Show location of each item on dimensioned plans and elevations, and large-scale details, including attachment devices, and other components.
 - 1. Show locations and sizes of blocking and nailers, including concealed blocking and reinforcing specified in other Sections.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying Work.
- B. Installer Qualifications: A firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.
- C. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
 - 1. Acceptable Lumber Inspection Agencies: WCLIB (GR) and WWPA G-5.

2. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Obtain and comply with woodwork manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage.
- B. Weather Limitations: Proceed with installation of exterior woodwork only when existing and forecasted weather conditions will permit work to be performed, and at least one coat of specified finish to be applied, without exposure to rain, snow, or dampness.
- C. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication.
 1. Show recorded measurements on final shop drawings.
 2. Verify locations of concealed framing, blocking, and reinforcements that support woodwork by accurate field measurements before being enclosed.
 3. Record measurements on final shop drawings.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide materials that comply with quality standard for each type of woodwork and grade indicated.

2.02 EXPOSED DIMENSION LUMBER

- A. Grading Agency: Western Wood Products Association, WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: Kiln-dry or MC15.
- D. Framing (2 x 2 through 2 x 6):
 1. Species: Western Cedar.
 2. Grade: Clear All Heart.
- E. Small Beam Framing (2 x 6 through 4 x 16):
 1. Species: Western Cedar.
 2. Grade: Select Heart.

2.03 EXPOSED BOARDS

- A. Moisture Content: Kiln-dry (15 percent maximum).
- B. Surfacing: S4S.

- C. Species: Western Cedar.
- D. Grade: Clear.
- E. Size: As indicated on drawings.
- F. Backout or groove backs of flat trim members, kerf backs of other wide, flat members, except for members with ends exposed in finished work.

2.04 FACTORY 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.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
 - 1. Manufacturers:
 - a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
 - b. Hoover Treated Wood Products, Inc: www.frtw.com.
 - c. Osmose, Inc: www.osmose.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
 - 1. Manufacturers:
 - a. Osmose, Inc; Product Advance Guard Brand Borate Pressure Treated Wood: www.osmose.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1 Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft retention.
 - a. Meeting AWPA P5 requirements and acceptable to authorities having jurisdiction and one of the following:
 - 1) Chromated copper arsenate (CCA).
 - 2) Ammoniacal, or amine, copper quat (ACQ).

- b. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - 1) Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - 1) Including wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members.
 - d. Treat lumber in contact with masonry or concrete.
 - 1) Including wood sills, sleepers, blocking, furring, stripping, and similar concealed members.
 - e. Treat lumber less than 18 inches above grade.
 - f. Treat items indicated on Drawings
3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1 Use Category UC2 and UC3B, Commodity Specification F (Treatment C9) using SBX (Borate).
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 - b. Treat items indicated on Drawings
 - c. Treat plywood used as furring.

2.05 INSTALLATION MATERIALS

- A. Blocking, Shims, and Nailers: Softwood or hardwood lumber, including Fire-retardant-treated softwood lumber kiln, dried to less than 15 percent moisture content.
- B. Screws: Select material, type, size, and finish required for each use, nonferrous metal or hot-dip galvanized, unless otherwise indicated. Comply with ASME B18.6.1 for applicable requirements.
 1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.
- C. Nails:
 1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, Hot-dip galvanized steel elsewhere.
- D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
 1. Provide nonferrous metal or hot-dip galvanized anchors and inserts, unless otherwise indicated.
- E. Insect Screens:
 1. Insect Screens: Woven aluminum mesh; 14/18 mesh size.

2.06 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible.
 1. Disassemble components only as necessary for shipment and installation.
 2. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

- D. Shop-cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items.
 - 1. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
 - 2. Smooth edges of cutouts and seal edges with a water-resistant coating suitable for exterior applications.

2.07 SHOP PRIMING

- A. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer compatible with finish coats to concealed surfaces of woodwork, including back.
 - a. Apply 2 coats to items installed over concrete or masonry.

PART 3 EXECUTION

3.01 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.02 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, reinforcements, and other related units of Work specified in other Sections to ensure that exterior architectural woodwork can be supported and installed as indicated.

3.03 INSTALLATION

- A. Install woodwork plumb, level, true, and straight with no distortions.
 - 1. Shim as required with concealed shims.
 - 2. Install to a tolerance of 1/8 inch in 96 inches for plumb and level.
- B. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- C. Anchor woodwork to studs, blocking built in or directly attached to substrates.
 - 1. Secure to studs, grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing for a complete installation.
 - 2. Provide fasteners that penetrate into wood substrate, minimum of 1-1/4 inch.
 - 3. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.
- D. Standing and Running Trim:
 - 1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 - 2. Do not use pieces less than 36 inches long, except where necessary.

3. Stagger joints in adjacent and related members.
 4. Install standing and running trim with no more than 1/8 inch in 96 inches variation from a straight line.
- E. Complete finishing work specified to extent not completed at shop or before installation of woodwork.
1. Fill nail holes with matching filler where exposed.
 2. Apply specified finish coats to exposed surfaces where only sealer/prime coats were applied in shop.
- F. Refer to Section 09 91 13, Exterior Painting for final finishing of installed architectural woodwork.

3.04 ADJUSTING

- A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork.
1. Adjust joinery for uniform appearance.

3.05 CLEANING

- A. Clean woodwork on exposed and semi-exposed surfaces.
1. Touch up shop-applied finishes to restore damaged or soiled areas.
- B. Waste Disposal: Comply with the requirements of Section 01 74 19.
1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
- C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

3.06 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 06 40 23
INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.
- B. Hardware and attachment accessories.
- C. Standing and Running Trim.
- D. Wood stairs.
- E. Wood plank ceiling boards
- F. Shop Finishing.
- G. Field Finishing.

1.02 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2022.
- 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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- G. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each type of product and process specified including installation instructions.
- C. Shop Drawings:
 - 1. Show location of each item with dimensioned plans and elevations, indicating materials, component profiles, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes.
 - 2. Show locations and sizes of cutouts and holes for plumbing and electrical work incorporated in woodwork.
 - 3. Show direction grain of wood faced items for transparent finish.
- D. Samples:
 - 1. Wood Veneer Faced Panel Products: Two 8 by 10 inch size samples with transparent finish for each species of wood specified.
 - 2. Plastic Laminate Clad Panel Products: Two 8 by 10inch size samples for each color, texture and pattern of plastic laminate and melamine material specified.

3. Solid Surfacing Materials: Two 6 by 9 inch samples.
4. Submit one sample of each hardware item in specified finish.
 - a. Approved samples may be used in the final installation.
- E. Certified Wood: Provide wood certification documentation, including chain-of-custody documentation, from the manufacturer declaring conformance with Forest Stewardship Council Guidelines for certified wood building components.

1.04 QUALITY ASSURANCE

- A. Comply with AWI - Architectural Woodwork Institute's Quality Standards for grades of woodwork, construction, finishes, and other requirements specified in this Section.
 1. Product to be AWI certified.
 - a. Exception: All woodwork, regardless of height, to be certified.
- B. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards, Custom quality, unless other quality is indicated for specific items.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- D. Fabricator and Installer Qualifications:
 1. Firm experienced in producing woodwork for projects of similar size, quality and complexity.
 2. Engage a firm qualified to assume single-source responsibility for fabricating, finishing, and installing Work of this Section.
- E. Surface Burning Characteristics: Not exceeding the following values indicated, per Building Code, when tested per ASTM E84.
 1. Class A:
 - a. Flame Spread: 0-25.
 - b. Smoke Developed: 0-450.

1.05 REGULATORY REQUIREMENTS

- A. Wood frames for fire door assemblies shall be labeled for fire resistance and smoke control ("S" label) in accordance with Building Code.
 1. Meet appropriate Factory Mutual, Underwriters Laboratories, or Warnock Hersey requirements and have acceptance label permanently attached to each fire door assembly.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 ENVIRONMENTAL CONDITIONS

- A. Do not deliver or install woodwork until building is enclosed, and heating and ventilating system is operating.
- B. Maintain Relative Humidity between 25% & 55% in areas that work is installed.

1.08 FIELD MEASUREMENTS

- A. Prior to fabrication, verify that field measurements are as indicated in Shop Drawings.

1.09 COORDINATION

- A. Coordinate the Work with plumbing and electrical rough-in, and other finish work.
- B. Coordinate with other trades for installation of concealed in-wall backing.

PART 2 PRODUCTS

2.01 MATERIALS - GENERAL

- A. Unless otherwise indicated provide products of quality specified by AWI Architectural Woodwork Quality Standards Illustrated for Premium grade.
- B. Unless otherwise indicated provide products of quality that comply with requirements of the AWI - Architectural Woodwork Institute's Quality Standards (AWS) Illustrated for Premium grade, will include the following Work:
 - 1. Interior standing and running trim.
 - 2. Handrails and chair rails.
 - 3. Window sills and apron.
 - 4. Door and window trim at casing and jamb.
 - 5. Interior frames and jambs.
 - 6. Interior mirror framing at public restrooms.
- C. See, Section 09 06 02 Materials and Finishes Schedule for additional information for Interior Architectural Woodworking.

2.02 LUMBER MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated.

2.03 SHEET MATERIALS

- A. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; glue type as recommended for application.
- B. Hardwood plywood for semi-exposed surfaces: Apple-Ply.
 - 1. See Section 09 06 02 Materials and Finishes Schedule.
- C. Particleboard: ANSI A208.1 composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.
 - 1. Manufacturer and Product: Duraflake FR; Arauco North America.
 - 2. Density.
 - 3. Fire-rated Particleboard.
 - 4. For vertical applications.
- D. Medium Density Fiberboard (MDF): Without formaldehyde, complying with ANSI A208.2
 - 1. Manufacturer: Roseburg; www.roseburg.com.
 - a. Medex, ANSI A208.2, Grade 155 MR50.
 - b. Medite FR, ANSI A208.2, Grade 130.
 - c. Medite II, ANSI A208.2, Grade 155 MR30.

- E. Thermoset Decorative Overlay: MDL Melamine Overlay as manufactured by one of the following, colors as selected from manufacturer's standard:
 - 1. Color: As selected by Architect from manufacturer's full standard range.
 - 2. Products:
 - a. Panel Source: a division of McKillican International, Inc.: Purekor Melamine Panels (FSC).
 - b. Roseburg; a Forest Products Company: Duramine Thermally Fused Laminate.
 - c. Tafisa: Tafilam (FSC).
 - d. Weyerhaeuser: Glacier Green Laminate Grade HDF.

2.04 WOOD PLANK CEILING BOARDS

- A. Style: T&G planks direct applied, See Section 09 06 02 Materials and Finishes Schedule
- B. Thickness: 5/8 inch.
- C. Application: Amenity Building.
- D. Manufacturer:
 - 1. Sustainable Northwest Wood; www.snwwood.com.

2.05 PLASTIC LAMINATE

- A. Plastic Laminate (PL): High pressure decorative laminate (HPDL), general purpose type, NEMA LD 3, types as indicated; manufacturer, color, pattern, and surface texture as indicated for each designation in Section 09 06 02 - Schedule for Finishes.
- B. Backing Sheet: NEMA LD 3, BK-20 backing grade, undecorated plastic laminate.
- C. Colors, Patterns, and Finishes: As indicated in Section 09 06 02 Materials and Finishes Schedule for color, pattern & finish.
- D. Joint Sealant: Clean translucent mildew-resistant silicone by Dow, General Electric, or approved.

2.06 GLASS

- A. Clear Float Glass: ASTM C1036, Type 1, Class 1, Quality q3.
 - 1. Thickness: 3/16 inch unless otherwise indicated.
- B. Clear, Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
 - 1. Thickness: 1/4 inch unless otherwise indicated.
- C. Mirror Glass for Doors: ASTM C1036, Type 1, Class 1, Quality q2, with back surface coated.
 - 1. Thickness: 1/8 inch unless otherwise indicated.

2.07 ACCESSORIES

- A. Adhesive: Aliphatic resin, Resorcinol, or approved.
- B. Fasteners: Size and type to suite application.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Select type, size, and finish to suite application.
- D. Screw Covers: Match adjacent surface in color and texture.
- E. Concealed Joint Fasteners: Threaded steel.

2.08 WOOD TREATMENT

- A. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- B. Provide identification on fire retardant treated material.
- C. Redry wood after pressure treatment to maximum 15% percent moisture content.

2.09 FABRICATION, GENERAL

- A. Fabricate interior woodwork complying with requirements of referenced AWI Quality Standard and Premium grade, unless otherwise indicated.
- B. Complete fabrication, assembly, finishing, and hardware application in shop to greatest extent possible before delivery to Project site.
 - 1. Disassemble only as required for shipping and to permit passage through building openings.
- C. When necessary to cut and fit on site, provide materials and ample allowance for cutting.
 - 1. Provide trim for scribing and site cutting.
- D. Locate opening accurately for hardware, appliances, plumbing fixtures and electrical work, and similar items, using templates or roughing-in diagrams.
 - 1. Seal edges with a water-resisting coating.

2.10 STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI/AWMAC/WI (AWS) for standing and running trim.
 - 1. Quality Standard: Premium.
- B. Wood Species: Birch, Plain Sawn.
 - 1. Size:
 - a. Base: 1 x 6 inch.
 - b. Door Casing: 1 x 3 inch.
 - c. Window Sill: 5/4 inch.
 - d. Window Skirt: 1 x 3 inch.
 - e. Minimal length without joints: 12 ft for horizontal trim.
- C. Groove backs of flat trim members, and kerf backs of wide, flat members. Terminate grooves or kerfs before reaching exposed ends of members.

2.11 STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Quality Standard: Comply with AWI/AWMAC/WI (AWS) for standing and running trim.
 - 1. Quality Standard: Custom.
- B. Wood Species: Any closed grain hardwood listed in AWI quality standard.
 - 1. Size:
 - a. Base: 1 x 6 inch.
 - b. Door Casing: 1 x 3 inch.
 - c. Window Sill: 5/4 inch.
 - d. Window Skirt: 1 x 3 inch.

- e. Minimal lengths without joints: 12 ft for horizontal trim.
- C. Groove backs of flat trim members, and kerf backs of wide, flat members. Terminate grooves or kerfs before reaching exposed ends of members.

2.12 SHELVING

- A. Closet and Utility Shelving: Comply with AWI requirements.
 - 1. Quality Standard: Custom.
 - 2. Material: Plywood veneer with solid lumber edges.
- B. Residential Manufactured Shelving:
 - 1. Wire shelf and rod system; prefinished with vinyl or epoxy coating.
 - a. 12 inch depth; verify with closet depth.
 - 2. Manufacturers and Products:
 - a. ClosetMaid Corporation SuperSlide #7316 shelf type: www.closetmaid.com.
 - b. RubberMaid Closet and Organization Products : www.rubbermaidcloset.com.
 - c. Schulte Corporation Ventilated Storage System: www.schultestorage.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.13 STAIRWORK AND RAILS

- A. Wood Species for Transparent Finish:
 - 1. Handrails: Maple

2.14 SHOP FINISHING

- A. General:
 - 1. Comply with AWI/AWMAC/WI (AWS) for factory finishing.
 - 2. The entire finish for architectural woodwork is specified in this Section regardless of whether shop or field applied.
 - 3. To the greatest extent possible, finish architectural woodwork in the fabrication shop.
 - 4. Sand work smooth and set exposed nails and screws.
 - 5. Apply wood filler in exposed nail and screw indentations.
 - 6. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.
 - 7. Touch up, clean, and polish after installation at Project site.
 - 8. Apply one coat of sealer or primer compatible with finish coats to concealed surfaces of architectural woodwork including backs of trim.
- B. Transparent Finish:
 - 1. Quality Standard: Premium.
 - 2. AWI Finish System: Pre-catalyzed lacquer (formerly TR-2).
 - 3. Staining: Match approved sample.
 - 4. Do not apply filler to open grained woods.
 - a. Apply pastewood filler to open grain woods after staining (if any). Wipe off excess.
 - b. Tint filler to match stained wood.
 - c. Apply vinyl washcoat sealer after staining and before filling
 - 5. Sheen: Flat 10-25 gloss units.

- C. Opaque Finish:
 - 1. Quality Standard: Premium.
 - 2. AWI Finish System: Nitrocellulose lacquer (formerly OP-1).
 - 3. Color: Match approved sample.
 - 4. Sheen: Flat 10-25 gloss units.

PART 3 EXECUTION

3.01 PREPARATION

- A. Condition architectural woodwork to prevailing humidity conditions in installation areas before installing.

3.02 PREPARATION

- A. Comply with AWI/AWMAC/WI (AWS) for the same grade specified for type of architectural woodwork involved, and specified.
- B. Shim as required with concealed shims.
 - 1. Install to tolerance of 1/8 inch in 8 feet for plumb and level.
- C. Scribe and cut woodwork to fit adjoining work. Refinish cut surfaces, and repair damaged finish at cuts.
- D. Anchor woodwork to concealed in-wall blocking or directly to substrates as required for proper support and attachment.
- E. Countersink anchorage devices at exposed locations and fill flush with adjacent surfaces matching finish, color and texture
- F. Complete finish work not completed in shop.
 - 1. Apply specified finish coats, including stains and paste fillers, to exposed surfaces where only sealer or primer coats were applied in shop.
- G. Standing and Running Trim:
 - 1. Install with minimum of joints possible.
 - 2. Do not use pieces less than 36 inches long.
 - 3. Stagger joints in adjacent and related members.
 - 4. Door Casing: Provide at doors frames unless indicated otherwise.
 - 5. Wood Base: Fill gaps between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base.
- H. Stairwork and Rails:
 - 1. Cut carriage to fit treads and risers and anchor to support framing.
 - 2. Glue treads to risers, and glue and nail treads and risers to carriages.
 - 3. Support wall railings on metal brackets and secure to wall framing.
 - 4. Install treads and risers not to exceed 1/8 inch from indicated position, and 1/16 inch out of position in respect to adjacent treads and risers.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.04 ADJUSTING

- A. Adjust hardware to center doors and drawers in openings.
- B. Adjust moving or operating parts to function smoothly and correctly.
- C. Touch up shop applied finishes and restore damaged or soiled areas.

3.05 CLEANING

- A. Clean woodwork on exposed and semi-exposed surfaces.
 - 1. Touch up shop-applied finishes to restore damaged or soiled areas.
- B. Waste Disposal: Comply with the requirements of Section 01 74 19.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
- C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

3.06 PROTECTION

- A. Provide protection and maintain conditions to ensure that woodwork is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK (CUSTOM)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Countertops.
- C. Hardware.
- D. Banquette Seating.
- E. Floating Wood Shelving.
- F. Decorative Metal.
- G. Factory finishing.
- H. Preparation for installing utilities.

1.02 REFERENCE STANDARDS

- A. ASTM C1036 - Standard Specification for Flat Glass 2021.
- B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
- G. BHMA A156.9 - Cabinet Hardware 2020.
- H. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.
- I. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.
- B. Coordinate the Work with plumbing and electrical rough-in, and other finish work.
- C. Coordinate with other trades for installation of concealed in-wall backing for support of cabinets.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
- E. Samples: Submit actual sample items of cabinet face finishes, 6 by 6 inch minimum for wood finishes, 4 by 4 inch minimum for all other finishes.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with AWI/AWMAC/NAAWS Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.
- B. 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. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. Do not deliver or install casework until building is enclosed, and heating and ventilating system is operating.
- B. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
 - 1. Maintain 50 degrees F temperature in areas that casework is installed.
 - 2. Maintain Relative Humidity between 25% & 55% in areas that work is installed.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 1. Wood Veneer Faced Cabinet:
 - a. Exposed Surfaces: HPVA HP-1 Grade A, Ash, plain sliced, random-matched.
 - b. Semi-Exposed Surfaces: HPVA HP-1 Grade B, Ash, plain sliced, random-matched.
 - c. Concealed Surfaces: Manufacturer's option.
 - 2. Plastic Laminate Faced Cabinets: Custom grade.
- B. Cabinet Finishes: As defined in Section 09 06 02 Material and Finishes Schedule.
 - 1. Exposed Exterior Surfaces, all Grades: varies per drawings.
 - 2. Exposed Interior Surfaces, all Grades: varies per drawings.
 - 3. Semi-Exposed Surfaces at Custom Grade: White melamine.
 - 4. Semi-Exposed Surfaces at Premium Grade: to match exposed exterior, varies per drawings.
 - 5. Finish - Concealed Surfaces, all Grades: Manufacturer's option.
 - 6. Edge Banding, all Grades: to match door, drawer, and panel face.
- C. Cabinets General Attributes unless noted otherwise.

1. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
2. Door and Drawer Front Retention Profiles: Fixed panel.
3. Casework Construction Type: Type A - Frameless.
4. Interface Style for Cabinet and Door: Flush Overlay.
5. Grained Face Layout for Cabinet and Door Fronts:
 - a. Style and Rail, all Grades. drawer fronts run grain either vertically or horizontally at the manufacturer's option; doors run vertical grain.
 - b. Flush Panel cabinet door and drawer fronts: Vertical grain.
 - c. Cabinet bodies: Vertical grain.
6. Adjustable Shelf Loading: 50 lbs. per sq. ft.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

- A. Softwood Lumber: NIST PS 20; Graded in accordance with, Grade II/Custom; average moisture content of 5-10 percent; species as recommended by manufacturer.
- B. Hardwood Lumber: NHLA; Graded in accordance with, Grade II/Custom; average moisture content of 5-10 percent; species as recommended by manufacturer.

2.04 PANEL MATERIALS

- A. Veneer Faced Plywood Finish: HPVA HP-1; graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, core of medium density fiberboard; type of glue recommended for specific application; thickness as required; face veneer as indicated in 09 06 02:
- B. Moisture-Resistant Plywood: ACX Plywood or Marine-grade plywood; graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, core of high density hardwood; waterproof glue recommended for specific application; thickness as required; face veneer as indicated in Section 09 06 02.

2.05 WOOD TREATMENT PROCESSES

- A. Fire Retardant Treatment: Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

2.06 LAMINATE MATERIALS

- A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- B. Provide specific types as indicated .
 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color.
 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.

- C. Thermoset Decorative Overlay: MDL Melamine Overlay, products and colors as indicated in Section 09 06 02. :

2.07 STAINLESS STEEL

- A. Stainless Steel: ASTM A167; 18 gauge, Type 302 or 304, No. 4 satin polished surface finish.

2.08 DECORATIVE METAL

- A. Type DM-1, DM-2, & DM-3; Decorative Metal Sheet Steel, Woven Wire Mesh, and Steel Rods where indicated, See Section 09 06 02 Materials and Finishes Schedule.

2.09 GLASS

- A. Clear Float Glass for Doors: ASTM C1036, Type I, Class 1, Quality q3, 3/16 inch thick, unless otherwise indicated.
 - 1. Ease and polish all exposed edges.
- B. Clear, Tempered Float Glass for Doors: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 3/16 inch thick, unless otherwise indicated.
 - 1. Ease and polish all exposed edges.
- C. Clear, Tempered Float Glass for Shelves: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 1/4 inch thick, unless otherwise indicated.
 - 1. Ease and polish all exposed edges.
- D. Decorative Glazing where indicated, as defined in Section 09 06 02 and specified in Section 08 80 00.

2.10 COUNTERTOP SUBSTRATE MATERIALS

- A. Plywood: Exterior softwood plywood complying with PS 1, Grade C-C Plugged, touch sanded.

2.11 COUNTERTOPS

- A. Countertops: See Section 12 36 00.

2.12 BANQUETTE SEATING

- A. Upholstered Cushions: Where indicated on Drawings
 - 1. Fabric Types: See Section 09 06 02 Materials and Finishes Schedule.
 - 2. Padding: LUX-HQ Foam by Foam Factory or equal.
 - a. Density: 2.8 lb/ cu. ft.
 - b. Fire Retardant treated.
 - c. Thickness: 1-1/2 inch unless indicated otherwise.
 - d. Fiberfill wrap at seat pads.
- B. Construction: As indicated on drawings.
- C. Finish: See Section 09 06 02 Materials and Finishes Schedule.

2.13 ACCESSORIES

- A. Adhesive: Type I (Waterproof).

- B. Joint Sealant: Clean translucent mildew-resistant silicone by Dow, General Electric, or approved.
- C. Screw Covers: Match adjacent surface in color and texture.
- D. Concealed Joint Fasteners: Threaded steel draw bolts.
- E. Grommets: Standard painted metal grommets for cut-outs, in color to match adjacent surface.

2.14 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Door and drawer pulls when not indicated: "U" shaped wire pull, satin stainless steel finish, 4 inch centers.
 - 1. Products:
 - a. Epco MC402-4-SS or approved equal; www.epcohardware.com.
- C. Clothes Rod: Knap & Vogt No. 660 with No. 735 support flanges.
- D. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
 - 1. Product: 1/4" dia 331 ANO Shelf Support, manufactured by Knap & Vogt .
- E. Concealed Shelf Support Bracket:
 - 1. Product: Richelieu Trade Rail: Concealed mounting brackets for shelves over 1-12 inches (40 mm) thick.
 - a. Mounting Rail: #1622510.
 - b. Concealed Mounting Bracket: XXL #1621712G.
 - c. Hardware: BP1622G.
- F. Fixed Specialty Shelf Supports - Concealed Flat Brackets:
 - 1. Type: Steel in-wall mounted support arms, support arm length determined by counter depth on drawings.
 - 2. Finish: Manufacturer's standard, factory-applied[<>] powder coat.
 - 3. Color: Selected by Architect from manufacturer's standard range.
 - 4. Products: Provide one of the following.
 - a. A&M Hardware, Inc; Concealed Flat Brackets: 1" or 2" wide.
<http://www.aandmhardware.com/#sle>.
 - b. A&M Hardware, Inc; Extended Concealed Flat Brackets: 1" or 2" wide.
<http://www.aandmhardware.com/#sle>.
 - c. Centerline Steel; Floating Wall Mount Countertop Bracket;
www.countertopbracket.com
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Fixed Specialty Workstation and Countertop Supports - Concealed Brackets:
 - 1. Type: Steel in-wall mounted support arms, support arm length determined by counter depth on drawings.
 - 2. Finish: Manufacturer's standard, factory-applied powder coat.
 - 3. Color: Selected by Architect from manufacturer's standard range.
 - 4. Products: Provide one of the following.
 - a. A&M Hardware, Inc; Hybrid Brackets: www.aandmhardware.com/#sle.

- b. A&M Hardware, Inc; Heavy-Duty Hybrid Brackets: www.aandmhardware.com/#sle.
 - c. A&M Hardware, Inc; Concealed Brackets: www.aandmhardware.com/#sle.
 - d. Rakks/Rangine Corporation; Inside Wall Flush Mount Brackets: www.rakks.com/#sle
 - e. Centerline Steel; Floating Wall Mount Countertop Bracket;
www.countertopbracket.com
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Fixed Specialty Counter Supports at bar/transaction counter:
1. Type: Steel in-wall mounted support arms, support arm length determined by counter depth on drawings.
 2. Finish: Manufacturer's standard, factory-applied powder coat.
 3. Color: Selected by Architect from manufacturer's standard range.
 4. Products: Provide one of the following.
 - a. A&M Hardware, Inc; Island Bar and Brackets: <http://www.aandmhardware.com/#sle>.
 - b. Centerline Steel; Standard Granite Countertop Support Brackets;
www.countertopbracket.com
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Drawer and Door Pulls at back of house cabinetry: "U" shaped wire pull, steel with satin finish, 4 inch centers.
1. Product: MC402-4-SS manufactured by Epco; www.epcohardware.com.
- J. Cabinet Catches and Latches:
1. Standard Cabinet Doors: Provide one per door.
 2. Closet Doors: Provide two per leaf.
- K. Drawer Slides:
1. Type: Full extension.
 2. Static Load Capacity: Commercial grade.
 3. Mounting: Side mounted.
 4. Stops: Integral type.
 5. Features: Provide self closing/stay closed type.
 6. Product Types:
 - a. Pencil Drawers: Accuride 2006, Steel ball bearings, 3/4 extension, load capacity up to 45 lbs. per pair.
 - b. Light to Medium Duty Drawers: Accuride 3832, Steel ball bearings, full extension, load capacity up to 100 lbs. per pair; for drawers that are deeper than they are wide.
 - c. Light to Medium Duty Drawers: Accuride 7432, Steel ball bearings, full extension, load capacity up to 100 lbs. per pair; for drawers 24 inches wide or less.
 - d. Medium to Heavy Duty Drawers: Accuride 4034, Steel ball bearings, full extension with 1 inch overtravel, progressive movement, load capacity 150 lbs. per pair; for drawers 24 inches wide or less.
 - e. Heavy Duty or Lateral File Drawers: Accuride 3640, Steel ball bearings, full extension with 1 inch overtravel, progressive movement, load capacity up to 200 lbs. per pair; for drawers 42 inches wide or less.
 7. Manufacturers:
 - a. Accuride International, Inc: www.accuride.com.
- L. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

1. 110 degree opening
2. Minimum three hinges for doors over 48 inches high.
3. Manufacturers:
 - a. Blum, Inc: www.blum.com.
 - b. Hardware Resources: www.hardwareresources.com.
 - c. Hettich America, LP: www.hettich.com.
 - d. Hafele: www.hafele.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- M. Silencers: Clear soft rubber round bumpers, two per door.
- N. Waste Bin:
 1. Two compartment waste bin pull out.
 2. Capacity: 30 qt.
 3. Materials:
 - a. Frame: Metal.
 - b. Bins: Plastic.
 4. Manufacturer:
 - a. Hafele; Product: 502-70-522; www.hafele.com.
- O. Cabinet Pocket Door Slides:
 1. Class: Medium-duty.
 2. Bracket: Surface-mounted.
 3. Slide: Manufacturer's standard steel ball-bearings.
 4. Manufacturers:
 - a. Hafele Accuride CB123-24D.

2.15 FABRICATION

- A. Prior to fabrication, verify that field measurements are as indicated in Shop Drawings.
- B. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- C. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- D. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
 1. Provide center matched panels at each elevation, unless indicated otherwise.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.16 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

- C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as indicated in Section 09 06 02:
 - 1. Transparent:
 - a. System - 5, Varnish, Conversion.
 - b. Sheen: Satin.
 - 2. Opaque:
 - a. Color: As selected by Architect.
 - b. Sheen: Satin.

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.

3.02 INSTALLATION

- A. Set and secure cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- G. Seal joints between backsplash and countertop with clear sealant.

3.03 ADJUSTING

- A. Adjust installed work.
- B. 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

**SECTION 06 42 00
WOOD PANELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Custom wood veneer paneling.
- B. Shop finishing.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

1.03 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on fire-retardant treatment materials and application instructions.
- C. 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 plan of panel number sequencing.
- D. Product Data:
 - 1. Provide data on fire retardant treatment materials and application instructions.
- E. Samples: Submit two samples of finished plywood, 8 x 10 inch in size, illustrating wood grain and specified finish.

1.04 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.05 QUALITY ASSURANCE

- A. 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 in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

- B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect work from moisture damage.
- B. Do not deliver wood materials to project site until building is fully enclosed and interior temperature and humidity are in accordance with recommendations of AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

PART 2 PRODUCTS

2.01 PANELING

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless otherwise indicated.
- B. Flat Paneling:
 - 1. Cut: See Section 09 06 02 Materials and Finishes Schedule.
 - 2. Panels: Veneer of full width and balanced sequence matched.
 - 3. Visible Edges and Reveals: Filled and painted.
 - 4. Outside Corners: Mitered and splined.

2.02 LUMBER MATERIALS

- A. See Section 09 06 02 Materials and Finishes Schedule.

2.03 ADHESIVES

- A. Adhesives: Type suitable for intended purpose, complying with applicable air quality regulations.
- B. Concealed Joint Fasteners: Threaded steel.
- C. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and chrome finish in exposed locations.

2.04 WOOD-TREATMENT PROCESSES

- A. Fire Retardant Treatment (FR-S Type) for Lumber: Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

2.05 SHOP TREATMENT OF WOOD MATERIALS

- A. Shop pressure treat wood materials requiring UL fire rating to concealed wood blocking.
- B. Provide UL approved identification on fire-retardant treated material.

2.06 FABRICATION

- A. At panels more than one leaf high, fabricate with architectural end matching.

- B. For all panels in an single area, provide full width premanufactured sets and doors and other components.
- C. Shop prepare and identify panels for grain matching during site erection.
- D. Prepare panels for delivery to site, permitting passage through building openings.
- E. Finish exposed edges of panels as specified by grade requirements.
- F. When necessary to cut and fit on site, provide materials with ample allowance for cutting and scribing.

2.07 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. 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. System - 5 Varnish Conversion.
 - b. Stain: As selected by Architect.
 - c. Sheen: See Section 09 06 02 Materials and Finishes Schedule.

2.08 ACCESSORIES

- A. French Cleat: Concealed panel clips
 - 1. Sized for panels.
 - 2. Z Clip by Monarch Metal Hanging Systems; www.monarchmetal.com.
 - 3. Panelclip by Brooklyn Hardware, sized for panels.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

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. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Do not begin installation until wood materials have been fully acclimated to interior conditions.
- C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.
- D. Where necessary to cut and fit on site, scribe work abutting other components. Do not use additional overlay trim to conceal gaps.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.04 CLEANING

- A. Clean exposed and semi-exposed surfaces.
 - 1. Touch up shop-applied finishes to restore damaged or soiled areas.
- B. Waste Disposal: Comply with the requirements of Section 01 7419.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
- C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

END OF SECTION

**SECTION 06 82 05
FIBERGLASS REINFORCED PLASTIC PANELS (FRP)**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced polyester panel system for adhesive mounting.
- B. Moldings, adhesive, and joint sealants.

1.02 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2023, with Editorial Revision.
- B. ASTM D570 - Standard Test Method for Water Absorption of Plastics 2022.
- C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics 2022.
- D. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30 C and 30 C with a Vitreous Silica Dilatometer 2016.
- E. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials 2017.
- F. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement 2020.
- G. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor 2013a.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- I. FDA Food Code - Chapter 6 - Physical Facilities Current Edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

1.04 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Marlite; www.marlite.com.

- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLICATIONS

- A. Provide plastic paneling in kitchen, behind bar, and in corridors leading to kitchen and bar area.

2.03 PANEL SYSTEM

- A. See Drawings and 09 06 03 Public Spaces Finishes.
- B. Plastic Panel System: Factory finished panels, trim, sealant, and accessories.
- C. Panels: FRP Panels; fiberglass reinforced polyester, USDA approved for incidental food contact.
1. Surface Burning Characteristics: Flame spread index of 200 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84 (Class C/III).
 2. Surface Texture: High-gloss, smooth.
 3. Color: As selected from manufacturer's standard selection.
 4. Thickness: 3/32 inch, nominal.
 5. Width: 48 inches.
 6. Height: 96 inches.
 7. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.
 8. Flexural Strength: 17,000 psi, when tested in accordance with ASTM D790.
 9. Flexural Modulus: 600,000 psi, when tested in accordance with ASTM D790.
 10. Tensile Strength: 8,000 psi, when tested in accordance with ASTM D638.
 11. Tensile Modulus: 9,430 psi, when tested in accordance with ASTM D638.
 12. Barcol Hardness: 40, when tested in accordance with ASTM D2583.
 13. Impact Resistance: 7 ft-lb/in, when tested in accordance with ASTM D256, Izod method.
 14. Coefficient of Thermal Expansion: 0.0000157 in/in/degree F, measured in accordance with ASTM D696.
 15. Water Absorption: 0.17 percent, when tested in accordance with ASTM D570.
 16. Specific Gravity: 1.53, when tested in accordance with ASTM D792.
- D. Panel Trim: Extruded PVC, in manufacturer's standard colors.
1. Outside corners, inside corners, edge trim, and division molding.
- E. Sealant: Marlite Silicone Sealant; gunnable silicone rubber; clear.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Take panels out of cartons and allow to acclimatize to room conditions for at least 48 hours prior to installation.

- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Clean surfaces thoroughly prior to installation.
- D. Protect existing surfaces from damage due to installation.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use the adhesives recommended by the panel manufacturer unless prohibited by local regulations; obtain manufacturer's approval of alternative adhesives.
- C. Install continuous bead of silicone sealant in each joint and trim groove and between trim and adjacent construction, maintaining 1/8 inch expansion space.
- D. Avoid contamination of panel faces with adhesives, solvents, or cleaners; clean as necessary and replace if not possible to repair to original condition.
- E. Protect installed products until completion of project.

3.04 CLEANING

- A. Clean exposed surfaces.
- B. Touch-up, repair or replace damaged products.
- C. Waste Disposal: Comply with the requirements of Section 01 74 19.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.

END OF SECTION

**SECTION 07 17 13
BENTONITE WATERPROOFING (BW)**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bentonite clay waterproofing panels and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- B. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- C. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2023, with Editorial Revision.
- D. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes 2020.
- E. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles 2015a.
- F. ASTM D4833/D4833M - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products 2007 (Reapproved 2020).
- G. ASTM D638 - Standard Test Method for Tensile Properties of Plastics 2022.
- H. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials 2017.
- I. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement 2020.
- J. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications 2018.
- K. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2017).
- L. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs 2022.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. See Section 01 30 00 - Administrative Requirements, for pre-installation meeting procedures.
- 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.

1.04 SYSTEM DESCRIPTION

- A. Bentonite waterproofing and prefabricated drainage composite system to prevent the passage of liquid water and installed without defects, damage or failure.
- B. Waterproofing to be two high strength geotextiles interlocked encapsulating granular sodium bentonite with an integrated polyethylene liner.

1.05 PERFORMANCE REQUIREMENTS

- A. Bentonite Waterproofing:
 - 1. Capable of resisting water head of 150 feet and preventing moisture migration to interior from walls and floors.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
- C. Shop Drawings: Indicate required flashings, sealing at openings.
- D. Certificate: Certify that products meet or exceed specified requirements.
- E. Test Report: Submit test report showing soil and water for contaminants are compatible with membrane.
- F. Manufacturer's Installation Instructions: Indicate special preparation of substrate, panel attachment methods, and perimeter conditions requiring special attention.
- G. Manufacturer's Technical Representative:
 - 1. Visit site minimum of three times.
 - a. Prior to installation.
 - b. During installation of membrane.
 - c. Before covering membrane.
 - 2. Document site visits in writing with copy to Architect.
- H. Warranty:
 - 1. Submit manufacturer sample warranty.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience and completed 10 successful projects of similar size and scope.

1.08 MOCK-UP

- A. Construct mock-up of 100 sq ft of horizontal waterproofing, representing finished work including internal and external corners.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Maintain bentonite products dry. Protect with waterproof cover.
- B. Maintain minimum ambient storage temperatures of 40 degrees F for bentonite gel products.

1.10 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application.

1.11 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a 1 year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water.
 - 1. Include in warranty coverage cost of repairing damage to building resulting from failure to prevent penetration of water.
 - 2. Exception: Where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: CETCO: www.cetco.com.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Bentonite: Granulated pure, dry, bentonite clay comprised of 90 percent minimum sodium montmorillonite; 90 percent minimum passing No. 20 mesh sieve and 10 percent maximum passing No. 200 mesh sieve.
 - 1. Sodium bentonite: Two (2) gram free swell minimum volume of 16 cc and a maximum fluid loss of 18ml in de-ionized water.

2.03 PRODUCT TYPES

- A. Bentonite Sheet: Bentonite interlocked-geotextile waterproofing with integrated polyethylene liner.
 - 1. Panel to consist of one woven and one non-woven polypropylene geotextile, interlocked using a needle-punching process that produces several interlocks per square inch (6.45 sq. cm) over the entire surface area of product with an integrated polyethylene liner on one side.
 - 2. Hydrostatic Pressure Resistance: 231 ft. per ASTM D5385/D5385M.
 - 3. Peel Adhesion to Concrete: 15 lbs per inch per ASTM D903.
 - 4. Tensile Strength: 95 lbs per ASTM D4632/D4632M.
 - 5. Puncture Resistance: 100 lbs. per ASTM D4833/D4833M.
 - 6. Nominal Panel Size: 48 x 174 inches.
 - 7. Minimum Bentonite Fill: 1.00 lb/sq ft.
 - 8. Product: Voltex DS by CETCO.

2.04 ACCESSORIES

- A. Fasteners: Galvanized nails.
- B. Adhesive:
 - 1. Multi-purpose, single component polyether moisture cure sealant/adhesive.

2. Gray, non-flammable, latex and water based adhesive used to secure waterstop products to concrete, metal and PVC horizontal and vertical surfaces.
3. Product: Cetseal by CETCO.
- C. Waterstop: Refer to Section 03 30 00.
- D. Liquid Flashing:
 1. Trowel grade sodium bentonite compound used as a detailing mastic around penetrations, corner transitions and grade terminations.
 2. Product: BentoSeal by CETCO.
- E. Trowel Grade Bentonite:
 1. Hydrophilic single component paste, 10.5 oz tube.
 2. Provide at membrane overlap seams.
- F. Product: Akwaswell by CETCO.
 1. 2 inch diameter x 2 feet long, water soluble tube container filled with granular sodium bentonite.
 2. Bentonite Tubes:
 3. Product: Hydrobar Tubes by CETCO.
- G. Seam Tape: 2 inch wide butyl rubber sealant tape.
- H. Bentonite Granules:
 1. Waterstoppage; 50 lbs. bag of granular sodium bentonite.
 2. Product: Type recommended by waterproofing manufacturer.
- I. Termination Bar: Min. 1 inch wide stainless steel bar with pre-punched holes on 12 inch centering for fastening.
- J. Joint Seal:
 1. Manufacturer:
 - a. Link-Seal modular seal assembly as manufactured by PSI-Thunderline/Link-Seal.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Each individual link to be conspicuously and permanently identified with the name of the manufacturer and model number.
 3. Modular Seal Rubber Links:
 - a. Modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
 - b. Elastomeric element sized and selected per manufacturer's recommendations.
 - c. Coloration to be throughout elastomer for positive field inspection. Each link to have permanent identification of the size and manufacturer's name.
 - 1) Standard Service Applications: Model C -40 to +250°F (-40 to +121°C) EPDM; ASTM D2000, M3 BA510, Color: Black.
 4. Modular Seal Pressure Plates:
 - a. Glass reinforced Nylon Polymer with the following properties:
 - 1) Izod Impact - Notched: 2.05ft-lb/in. per ASTM D256.
 - 2) Flexural Strength @ Yield: 30,750 psi per ASTM D790.
 - 3) Flexural Modulus: 1,124,000 psi per ASTM D790.
 - 4) Elongation Break: 11.07% per ASTM D638.
 - 5) Specific Gravity: 1.38 per ASTM D792.

- b. Fire and Hi-Temp Service: 2-part Zinc Dichromate Coating.
- 5. Modular Seal Hardware:
 - a. Fasteners: Sized according to latest Link-Seal modular seal technical data. Bolts, flange hex nuts shall be either:
 - 1) Mild Steel: 60,000 psi minimum tensile strength and 2-part Zinc Dichromate coating per ASTM B633.
 - 2) Organic Coating: ASTM B117, pass a 1,470 hour salt spray test.
 - 3) Type 316 Stainless Steel: ASTM F593, with a 85,000 psi average tensile strength.
- 6. Wall Openings:
 - a. Wall opening (i.e. steel sleeve, Thermoplastic (HDPE) sleeve, cored hole or formed hole): Sized per manufacturers recommendations.
 - b. Century-Line Sleeves: Openings to 24 inch diameter.
 - c. Pipes passing through walls and floors:
 - 1) Molded non-metallic high density polyethylene Model CS Century-Line sleeves as manufactured by PSI-Thunderline/Link-Seal.
 - d. Model CS sleeves:
 - 1) Integrally formed hollow water stop sized having a minimum of four inches larger than the outside diameter of the sleeve itself.
 - 2) Allow 1/2 inch movement between wall forms to resist pour forces.
 - e. Sleeve assembly:
 - 1) End caps manufactured of the same material as the sleeve.
 - 2) Installed at each end of the sleeve so as to prevent deformation during the initial concrete pour, and to facilitate attaching the sleeve to the wall forms.
 - 3) End caps to remain in place to protect the opening from residual debris and rodent entry prior to pipe insertion.
- K. Drainage Panel:
 - 1. Drainage Panel: 1/4 inch thick formed plastic, hollowed sandwich.
 - a. Location: Below grade, with and without bentonite panels as noted on drawings.
 - b. Product: Aquadrain 15X manufactured by CETCO.
 - 2. Drainage Panel Connection: 1 inch thick formed plastic, hollowed sandwich.
 - a. Height: 12 inches.
 - b. Location: At base of below grade walls as noted on Drawings.
 - c. Product: Aquadrain 100BD manufactured by CETCO.
- L. Protection Board: Type recommended by waterproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are smooth and durable; free of matter detrimental to application of waterproofing system.
- C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

- A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- B. Remove concrete fins, projections, and form ties.
- C. Fill holes, cracks, honeycombs, and voids with bentonite gel seal, at least 1/8 inch thick, extending 3 inches, minimum, beyond defect.

3.03 INSTALLATION - GENERAL

- A. Install bentonite waterproofing in accordance with manufacturer's written instructions except where more stringent requirements are indicated herein.
- B. Install Waterproofing System with the woven side (dark gray) of the geotextile liner facing the concrete to be waterproofed in both horizontal and vertical applications.
- C. Secure center line of Waterproofing System to shoring wall with pneumatic staples or washer-head fasteners as required to hold membrane tight against shoring wall.
- D. Prior to installing adjacent sheets or panels on walls or below slabs apply continuous 3/8 inch bead of trowel grade bentonite along top and side edges of previously installed Sheet.
 - 1. Install trowel grade bentonite approximately 3 inch from sheet edge so that the trowel grade bentonite will be confined within the 6 inch overlap. In lieu of trowel grade bentonite bead, a minimum 1/4 inch thick by 3 inch wide trowel of bentonite mastic can be used within the overlaps.
- E. Apply hydrobar tube at intersection of footings and foundation walls.

3.04 INSTALLATION - VERTICAL SURFACES

- A. Install bentonite waterproofing in accordance with manufacturer's written instructions.
- B. Provide a minimum of 6 inch overlap between underslab and vertical wall waterproofing. Place Hydrobar Tubes along the wall/footing intersection with ends "buted" tightly together to form a continuous installation.
- C. Trowel 3/4 inch thick, continuous bentonite mastic fillet at inside wall corner transitions. Trowel bentonite mastic form-tie pockets/patches and any slightly irregular honeycomb areas.
- D. Starting at base of wall, install Bentonite Sheet or Polymer Sheet horizontally (dark gray woven geotextile against the wall; poly side facing installer) covering the Hydrobar Tubes and overlap waterproofing membrane from underslab work a minimum of 6 inches.
 - 1. Attach Bentonite Sheet or Polymer Sheet using washer-headed mechanical fasteners centered 24 inches around the sheet edge. Overlap all adjacent sheet edges a minimum 6 inches.
 - 2. Stagger vertical overlap seams a minimum of 12 inches.
 - 3. Prior to installing adjacent Bentonite Sheet or Polymer Sheet, apply continuous 3/8 inch bead of trowel grade bentonite along top and side edges of installed Voltex DS sheet.
 - 4. Install trowel grade bentonite approximately 3 inch from sheet edge so that the Trowel Grade Bentonite will be confined within the 6 inch overlap.
 - 5. In lieu of trowel grade bentonite, a minimum 1/4 inch thick by 3 inch wide trowel of bentonite mastic can be used within the Bentonite Sheet or Polymer Sheet overlaps.

- E. After the bottom horizontal course, Bentonite Sheet or Polymer Sheet can be installed either vertically or horizontally oriented.
 - 1. Continue Bentonite Sheet or Polymer Sheet installation up wall to finished grade elevation, staggering all sheet roll ends of adjacent courses a minimum 12 inches.
 - 2. Do not allow horizontal Bentonite Sheet or Polymer Sheet overlap joints to run at same elevation as the concrete pour lift joints.
 - 3. Overlap all adjacent Bentonite Sheet or Polymer Sheet edges a minimum 6 inches.
- F. Cut Bentonite Sheet or Polymer Sheet to fit snugly around penetrations.
 - 1. Detail around all penetrations with 3/4 inch cant of bentonite mastic.
 - 2. Completely fill any space between the penetration and Bentonite Sheet or Polymer Sheet edge.
 - 3. Extend bentonite mastic. 1/4 inch thick over substrate a minimum radius of 1-1/2 inches and onto penetration.
- G. Terminate Bentonite Sheet or Polymer Sheet at grade with metal termination bar fastened 12 inches on center. Cover top edge of Sheet with 1/2 inch thick, 2 inch wide layer of bentonite mastic.
- H. Inspect finished Bentonite Sheet or Polymer Sheet installation and repair any damaged material prior to backfill placement. Assure that Bentonite Sheet or Polymer Sheet is not displaced during backfill placement or soil compaction.
 - 1. Care should be used during backfill operation to avoid damage to the waterproofing system. Backfill Work should follow generally accepted practices for backfilling and compaction. Backfilled soils should be added in 6 to 12 inches lifts and compacted to a minimum 85% Modified Proctor density.

3.05 WATERSTOPS

- A. Install waterstop in all applicable vertical and horizontal cast-in-place concrete and shotcrete construction joints; and around applicable penetrations and structural members.
 - 1. Install waterstops on dry concrete surfaces.
 - 2. Place waterstop to allow for minimum 3 inch concrete coverage on all sides.
 - a. 2 inch coverage for RX-102.
 - 3. Construction cold joints at shotcrete walls to receive 2 rows of waterstop.
- B. Apply adhesive to dry, smooth concrete surface maintaining a minimum 3 inch depth within concrete joint.
 - 1. Allow adhesive to dry until the adhesive cures black (5-10 minutes in warm weather; cold weather will extend drying time).
- C. Remove release paper from coil of waterstop. Firmly press the entire length of waterstop against the cured (black) adhesive.
 - 1. Verify 3 inch minimum concrete coverage will be maintained over entire placement of waterstop.
 - 2. Place in maximum practical lengths to minimize coil end joints.
- D. Tightly butt coil ends together to form continuous waterstop. Do not overlap coil ends. Where required, cut coils with sharp knife or utility blade to fit coil ends together without overlapping.

- E. Following steps above install waterstop around all applicable through wall pipes and mechanical penetrations; and around all applicable structural elements like metal H-Piles through the slab.
- F. Protect installed waterstop from prehydration prior to concrete placement and product encapsulation.
- G. Replace any waterstop material that exhibit significant expansion prior to concrete encapsulation.

3.06 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

- A. Install drainage panel directly over waterproofing, butt joints, and position to ensure downward drainage.
- B. Install protection board over drainage panel; butt joints.
- C. Scribe and cut boards around projections, penetrations, and interruptions.
- D. Adhere protection board to substrate with mastic/adhesive approved by manufacturer.

3.07 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services:
 - 1. Furnish written certification that surface preparation method and final condition has manufacturer's approval and comply with warranty period specified.

3.08 PROTECTION

- A. Do not permit traffic over unprotected or uncovered waterproofing.
- B. Cover installed waterproofing with temporary polyethylene sheeting; remove sheeting just before backfilling begins.
 - 1. Protect transition between vertical to horizontal surfaces with protection board until transition waterproofing is complete and backfill is in place.

3.09 CLEANING

- A. After completing installation, remove and recycle debris excess materials and debris from project site per Section 01 74 19.

END OF SECTION

**SECTION 07 18 00
TRAFFIC COATINGS (TC)**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Waterproof coatings for traffic surfaces.

1.02 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.

1.03 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Include product characteristics and limitations. Identify dissolving solvents, fuels, and potential destructive compounds.
- C. Samples: Submit two fully cured samples of membrane, 8 x 8 inch in size, illustrating color, surface texture, and variations.

1.04 DOCUMENTATION FOR SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for site information:
 - 1. Test reports.
 - 2. Manufacturer's Installation Instructions: Include special field conditions required to install traffic membrane and potential incompatibilities with adjacent materials.
 - 3. Coordination Drawings.
 - 4. Other types indicated.
- D. Documentation for Site Information maybe reviewed by Architect for reference.

1.05 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data: Include procedures for stain removal, repairing surface, and cleaning.
 - 3. Warranties.
 - 4. Submittals for Site information
 - 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.06 PRE-INSTALLATION MEETING

- A. Convene two (2) weeks before starting work of this section.
- B. Attendees:
 - 1. Architect
 - 2. Contractor
 - 3. Applicator
 - 4. Building Envelope Consultant
 - 5. Manufacturer's technical representative
- C. Agenda:
 - 1. Review schedule
 - 2. Review substrates
 - 3. Review locations
 - 4. Review mock-ups
 - 5. Review testing procedures

1.07 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 installation of traffic membrane, with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Delivery products to job site in manufacturer's original containers, and maintain with labels intact and legible.
- C. Maintain storage area at minimum ambient temperature of 55 degrees F.
- D. Keep away from fire or open flame.

1.09 FIELD CONDITIONS

- A. Comply with local regulations regulating use of products containing VOC's.
- B. Do not install materials when temperature is below 50 degrees F or above 90 degrees F.
- C. Maintain this temperature range, 24 hours before, during and 72 hours after application.
- D. Restrict traffic from area where materials are being installed or are curing.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for delamination of system from substrate and degradation of waterproofing ability. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Pedestrian Traffic Membrane:
 - 1. Basis of Design: Tremco Global Sealants; Product: Vulkem 360NF (Base Coat)/951NF (Top Coat); www.tremcosealants.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COATINGS

- A. Base Coat: 350NF.
 - 1. Solids by Weight: 91 percent per ASTM D1353.
 - 2. Elongation: 500 percent per ASTM D412.
 - 3. Tensile Strength: 275 psi per ASTM D412.
 - 4. Hardness (Shore A): 40 to 50 per ASTM D2240.
 - 5. Adhesion (Peel Strength): Unprimed concrete, 45 pli, 100 percent cohesion failure per ASTM D903.
 - 6. Adhesion (Pull-Off): 350 psi per ASTM D4541.
 - 7. Abrasion Resistance (1000 Cycles): N/A.
- B. Top Coat: 951NF.
 - 1. Solids by Weight: 80-85 percent per ASTM D1353.
 - 2. Elongation: 145 percent per ASTM D412.
 - 3. Tensile Strength: 4500 psi per ASTM D412.
 - 4. Hardness (Shore D): 50 per ASTM D2240.
 - 5. Adhesion (Peel Strength): 100 percent cohesion failure per ASTM D903.
 - 6. Adhesion (Pull-Off): 350 psi per ASTM D4541.
 - 7. Abrasion Resistance (1000 Cycles): 33mg.

2.03 TRAFFIC MATERIALS

- A. Traffic Coating: Liquid polyurea coating, two-component mixture applied in two or more coats with color of top coat
 - 1. Reinforce all vertical to horizontal transitions, 2 inch beyond outside face of cladding and 4 inches up wall.
- B. Reinforcement: Type recommended by manufacturer for application.
- C. Surfacing: Provide manufacturer's standard aggregate of size and gradation recommended for application indicated..
- D. Filler and Primer: As recommended by membrane manufacturer.
- E. Cant Strips: 1 x 1 inches x 45 degrees,, mixture of aggregate and basecoat.
- F. Flashing Sheets and Accessories: Types as recommended by traffic coating manufacturer; supplied for locations indicated and for locations recommended by manufacturer.
 - 1. Reinforced Mesh: Type as recommended by traffic coating manufacturer for transition.
- G. Color: Custom color to match Architect's sample.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate is ready to receive work, surface is clean, dry and free of substances that could adversely effect bond.
- B. Do not begin work until concrete substrate has cured at least 28 days and moisture content is acceptable to manufacturer.
- C. Conditions under which Work is to be performed is satisfactory.
 - 1. Notify Contractor of unsatisfactory conditions.
 - 2. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
- D. Test concrete surfaces according to ASTM F710 for acceptable level of alkalinity.

3.02 PREPARATION

- A. Clean substrate surface free of foreign matter.
 - 1. Clean surfaces as recommended by coating manufacturer for adhesion of coating, and for removal of laitance, contaminants and curing compounds.
- B. Prime and seal substrate as recommended by coating manufacturer.
- C. Install reinforcement at vertical/horizontal joints and cants.
- D. Install cant strips securely at intersecting surfaces.
- E. Protect adjacent surfaces.

3.03 INSTALLATION

- A. Prestripe working joints per manufacturer's instructions.
- B. Apply system materials in accordance with manufacturer's written instructions.
 - 1. Start installation of traffic coating only in presence of manufacturers technical representative where terms of warranty requires inspection and acceptance of installation as it proceeds
- C. Apply total thickness of traffic coating in number of coats recommended by manufacturer, using top coating to achieve wear resistance and weather resistance as required, and to provide color and texture.
 - 1. Total thickness: 45 mils dry, minimum.
- D. Extend primer, base and top coats up intersecting and perimeter vertical surfaces, as indicated, or otherwise recommended by manufacturer. Terminate top edge in a straight line.
- E. Finish to smooth surface sloped to drains. Cove at vertical surfaces.
- F. Apply surfacing to top coat before set.
- G. Apply sealant to junction of horizontal and intersecting surfaces to achieve watertight seal.

3.04 PROTECTION

- A. Do not permit traffic over unprotected surfaces.

END OF SECTION

**SECTION 07 19 00
WATER REPELLENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water repellent applied to exterior:
 - 1. Concrete.
- B. Anti-Graffiti repellent applied to:
 - 1. Concrete.

1.02 REFERENCE STANDARDS

- A. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete 2021.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings 2005 (Reapproved 2018).
- C. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments 1991 (Reapproved 2022).

1.03 SYSTEM DESCRIPTION

- A. Water repellents applied to the following:
 - 1. Concrete
- B. Anti-Graffiti Repellent applied to the following:
 - 1. Concrete

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Technical representative to report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
 - 1. Include statement the warranty covers Anti-Graffiti Repellent Coating for 10 tags as stated below.
- G. Quality Control Submittals:

1. Statement of qualifications.
2. Statement of compliance with Regulatory Requirements.
3. Field Quality Control Submittals as specified in Part 3.
4. Manufacturer's field reports.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Manufacturer's Technical Representative to make minimum of two (2) site visits, before and after application of materials, and document visits in writing.
 1. First site visit is to demonstrate removal of graffiti from their product when installed on project substrate.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience
 1. Currently approved by manufacturer,
 2. Successfully completed minimum 3 projects of similar size, quality and complexity under present name.
- D. Provide materials that are VOC compliant in accordance with the State in which the Project is located.

1.06 MOCK-UP

- A. Review manufacturer's product data sheets to determine suitability of each product for each surface.
- B. Apply products using manufacturer-approved application methods, determining actual requirements for surface preparation, coverage rate, number of coats, and application procedures.
- C. After 48 hours, review effectiveness of protection, compatibility with substrates, and ability to achieve desired results.
- D. Obtain approval by Architect and Owner of workmanship, color, and texture before proceeding with work.
- E. Test Panels: Inconspicuous sections of actual construction.
 1. Location and number as selected by Architect.
 2. Size: 4 feet by 4 feet.
 3. Repair unacceptable work to the satisfaction of the Architect and Owner.
 4. Test panels to include water repellent and anti-graffiti repellent.
 - a. Anti-graffiti repellent coating to be tagged and cleaned.
- F. Approved mock-up constitutes standard for workmanship.
- G. For proposed substitutions, prepare side-by-side mock-ups of specified and substitute products.
- H. Locate where directed.
- I. Mock-up may remain as part of the Work.
- J. Convene two weeks before starting work of this section.

1.07 PROJECT CONDITIONS

- A. Do not apply products under conditions outside manufacturer's requirements.
- B. Coordination:
 - 1. Verify compatibility of water repellent with curing compounds, patching materials, repair mortar, paints, sealants, etc. to be used on masonry surfaces.

1.08 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water repellent when surface temperature is lower than 40 degrees F or higher than 100 degrees F.
- C. Do not proceed with application of materials in rainy conditions or if rain is anticipated with 4 hours after application.
- D. Substrate to meet manufacturer's written instructions for dryness prior to application.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and storage:
 - 1. Deliver materials to job site in manufacturer's unopened containers with labels intact and legible at time of use.
 - 2. Maintain packaged materials with seals unbroken and labels intact until time of use.
 - 3. Protect from damage or contamination.

1.10 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in work of those trades for interface with Work of this Section.
- B. Protect work of others from damage including over-spraying.

1.11 MANUFACTURER'S WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Water Repellent: Silane-Siloxane Blend.
 - 1. Basis of Design: Evonik Industries, Chemicals Business Area (formerly Degussa Corp): www.protectosil.com.
 - 2. Fabrikem Manufacturing, LTD: www.fabrikem.com.
 - 3. PROSOCO, Inc: www.prosoco.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.

1. Siloxane- or silane- or siloxane-silane blend, without fillers, stearates, or paraffins.
Applications: Vertical surfaces and non-traffic horizontal surfaces.
 2. Number of Coats: As recommended by manufacturer.
 3. VOC Content: Less than 400 g/L, when tested in accordance with ASTM D3960 or ASTM D5095.
 4. Products Containing Silane: Minimum 40 percent solids.
 5. Moisture Absorption When Applied to Concrete: Five percent, maximum, when tested in accordance with ASTM C642 concrete sample completely coated with water repellent.
 6. Maintains dry appearance when wetted.
 7. Silane, siloxane, silane-siloxane blend, or silicate that reacts chemically with concrete and masonry.
 8. Manufacturers:
 - a. Basis of Design: Evonik Industries; Product Protectosil Chem-Trete 40 VOC.
 - b. Fabrikem Manufacturing, LTD; Product Fabrishield 761. [VOC<45g/l].
 - c. PROSOCO, Inc; Consolideck SL100 Water Repellent, with VOC of 400 g/L or less: www.prosoco.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Anti-Graffiti Repellents
1. Water-based, fluorosiloxane (active substance) and following characteristics:
 - a. Type: Non-sacrificial.
 - b. VOC Content: <20 g/L.
 - c. Color: Clear or unobtrusive
 2. Manufacturers:
 - a. Basis of Design: Protectosil Antigraffiti by Evonik Industries.
 - b. Fabrikem Manufacturing, LTD;
 - 1) Concrete or Stone: Fabrishield Paint Repellent PR-60, VOC's = 67 g/l.
 - 2) Brick: Fabrishield Paint Repellent PR-61, VOC's = 67 g/l.
 - 3) CMU: Fabrishield Paint Repellent PR-63, VOC's = 67 g/l.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that pointing and patching of masonry surfaces has been completed
- C. Verify joint sealants are installed and cured.
- D. Verify that concrete and masonry surfaces have cured 7 days minimum before starting application.
- E. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.
- F. Verify masonry joints found to be unsound, hollow, or otherwise defective, have been raked out to a depth of 1/2 inch and pointed with mortar.
- G. Verify cracks that exceed 1/64 inch wide have been filled with pointing mortar.

- H. Correct conditions detrimental to timely and proper completion of Work.
 - 1. Do not proceed until unsatisfactory conditions are corrected.
- I. Do not begin until mock-up/test panels have been approved by Architect.

3.02 PREPARATION

- A. Protection: Install coverings to protect adjacent surfaces.
- B. Remove loose particles and foreign matter.
- C. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.
- D. Mask off exposed surfaces adjacent to substrates to receive water repellent.
- E. Scrub and rinse surfaces with water and let dry.
- F. Seal joints with sealant and allow to cure completely.
- G. Repair, patch and fill cracks, voids, defects, and damaged areas to satisfaction of Architect; allow repair materials to cure completely.
- H. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.
- I. Verify locations of termination datums for each product with Architect prior to commencement of Work

3.03 APPLICATION

- A. Apply repellent in accordance with manufacturer's written instructions, using procedures and application methods recommended.
 - 1. Comply with requirements of governmental authorities having jurisdiction.
 - 2. Test materials to received repellent to establish application rate, for specified warranty.
- B. Apply at rate recommended by manufacturer, continuously over entire surface.
- C. Apply two coats, minimum.
- D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.
- E. Keep wet edge at until complete surface plane has been sprayed.
- F. Apply at temperature and weather conditions recommended by manufacturer or as specified herein.
- G. Follow manufacturers recommendations concerning protection of glass, metal and other non-porous substrates.
 - 1. Clean surfaces contaminated by water repellent.
- H. Follow manufacturer's recommendation concerning protection of plants, grass and other vegetation.
 - 1. Replace plants, grass or vegetation damaged by repellent.
- I. Brush apply repellent only at locations where overspray would affect adjacent materials and where not practicable for spray application.

3.04 FIELD QUALITY CONTROL

- A. Mock-up Test Area:
 - 1. Before application of field coating provide following evaluation:
 - a. Cost of field testing will be responsibility of Water Repellent Manufacturer.
 - 2. Run RILEM uptake test:
 - a. Place one tube on masonry and one on mortar joint.
 - b. Contact Architect prior to application of repellent and test.
 - c. Acceptable minimum results are as stated in warranty provisions.
 - d. Coverage rate used to pass this test section must be used on entire project.
 - 3. Anti-Graffiti repellent coating to be tagged and cleaned to verify application and coating performance.
- B. Field Spray Test: After repellent has been applied to entire building and repellent has cured, spray coated surfaces with water.
 - 1. After surfaces have adequately dried, recoat surfaces that show water absorption.
 - 2. Run random RILEM tests on vertical elevations of structure at location selected by Architect.
 - a. Recoat surfaces that show water absorption.
- C. Manufacturer's Field Services:
 - 1. Furnish written certification that surface preparation method and final condition has manufacturer's approval and comply with warranty period specified.
 - 2. Test area: Furnish results of test area absorption on each type of substrate. Test results shall determine application rate.
- D. Upon completion remove repellent from unintended surfaces immediately by a method instructed by repellent manufacturer.

3.05 CLEANING

- A. Protect repellents substrates from damage and wear during construction period.

3.06 COMPLETION

- A. Work that does not conform to specified requirements to be corrected and/or replaced.

END OF SECTION

**SECTION 07 21 00
THERMAL AND ACOUSTICAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall.
- B. Batt insulation and vapor retarder in exterior wall and ceiling construction.
- C. Spray foam insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- D. Acoustical insulation.

1.02 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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide with materials of this Section a continuity of thermal and vapor retarder at building enclosure elements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with Section 07 25 09 - Self-Adhered Membrane Weather Barriers.
- B. Sequencing: Ensure fireproofing, firestop, and air barrier materials are in place before beginning work of this section.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
 - 1. Hydrofluorocarbon (HFC) and Global Warming Potential (GWP): Provide letter from insulation manufacturer stating products provided to job site meet State and Federal regulations related to HFC and GWP for the Extruded Polystyrene (XPS) or Polyisocyanurate (ISO) Insulation.

- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Sustainable Design Submittals:
 - 1. Foam Certificates: Certify that foam insulation meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Use workers who are trained and experienced in necessary crafts and who are familiar with requirements and methods needed for proper performance of Work of this Section.
- B. Certification: Upon completion of Work, complete and post as certificate of insulation compliance in accordance with requirements of governmental agencies having jurisdiction.

1.07 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.08 MOCK-UP

- A. See Section 01 43 39 for free standing mock-up.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene Board (XPS): ASTM C 578, Type VII; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
 - 1. Application: Perimeter foundation walls as indicated on drawings.
 - 2. Type and Compressive Resistance: Type VII, 60 psi (414 kPa), minimum.
 - 3. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 - 4. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 5. Board Insulation to be Chlorofluorocarbon (CFC) free and meet the Global Warming Potentials requirements.
 - 6. Board Size: 48 x 96 inch.
 - 7. Board Thickness: 3 inches, minimum or as indicated on drawings.
 - 8. Board Edges: Square.
 - 9. Thermal Resistance: LTTR-value= 5 per inch.
 - 10. Compressive Resistance: 60 psi.
 - 11. Board Density: 1.6 lb/cu ft.
 - 12. Water Absorption, maximum: 0.3 percent, volume.
 - 13. Manufacturers:
 - a. Basis of Design: Dow Chemical Co; Product Styrofoam Brand Square Edge Insulation: www.dow.com.
 - b. Owens Corning Corp: www.owenscorning.com.
 - c. Pactiv Building Products: greenguard.pactiv.com.
 - d. Insulfoam LLC; www.insulfoam.com.
 - 14. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BATT INSULATION MATERIALS

- A. Fiberglass Batt: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 2. Formaldehyde Content: Zero.
 - 3. Thermal Resistance: As indicated on drawings.
 - 4. Products:
 - a. Basis of Design: CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Knauf Insulation: www.knaufinsulation.com.
 - d. Owens Corning Corp: www.owenscorning.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Mineral Fiber Batt: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Products:
 - a. ROXUL, Inc; COMFORTBATT: www.roxul.com/#sle.

2.03 ACOUSTICAL INSULATION

- A. Acoustic Batt: ASTM C665; preformed glass or mineral fiber batt; friction fit, conforming to the stud size shown on the drawings.
 - 1. Thickness: 3-1/2 inch or as indicated on drawings.
 - 2. Facing: Unfaced.
 - 3. Density: 1.0 lbs/ft³ minimum.
 - 4. Flame/Smoke Properties: 25/50 in accordance with ASTM E 84.
 - 5. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville Corporation: www.jm.com.
 - c. Knauf Insulation: www.knaufinsulation.com.
 - d. Owens Corning Corp: www.owenscorning.com.
 - e. Substitutions: See Section 01600 - Product Requirements.

2.04 ACCESSORIES

- A. Sheet Vapor Retarder: Polyimide film vapor retarder for use with unfaced, vapor permeable glass fiber and mineral wool insulation in wall and ceiling cavities.
 - 1. Water Vapor Permeance:
 - a. ASTM E 96, dry cup method: 1.0 perms.
 - b. ASTM E 96, wet cup method: 10.0 perms.
 - 2. Fire Hazard Classification: ASTM E 84:
 - a. Maximum Flame Spread Index; 25.
 - b. Maximum Smoke Developed Index; 450.

3. Manufacturers:
 - a. Basis of Design: CertainTeed Corporation; Product: MemBrain; www.certainteed.com.
 - b. Substitutions: See Section 01600 - Product Requirements.
- B. Tape: Cellophane self-adhering type, pressure sensitive, mesh reinforced, 2 inch wide.
 1. Product: Scotch 610 as manufactured by 3M.
 2. Substitutions: See Section 01600 - Product Requirements.
- C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- D. Wire Mesh: 18 ga. minimum, galvanized steel, hexagonal wire mesh.
- E. Adhesive: Type recommended by insulation manufacturer for application.
 1. Adhesives and Sealants - General: All products installed inside of the building shall have a lower volatile organic compound (VOC) content than required by LEED credit EQ4.1 (Low-Emitting Materials, Adhesives and Sealants).
- F. Spray Foam Sealant:
 1. HCFC-based spray applied polyurethane foam, ASTM C 1029.
 2. Products:
 - a. Basis of Design: Great Stuff by Dow Chemical Co.
 - b. Daptex Plus by DAP Products Inc.
 - c. Substitutions: See Section 01600 - Product Requirements.
 3. Locations:
 - a. Where board insulation does not meet or does not entirely fill cavity.
 - b. Inside stud cavities surrounding openings.
 - c. Miscellaneous cavities at brick veneer assemblies, including at ledger angles.
 - d. Other locations indicated.
- G. Insulation Baffles: Preformed high-impact polystyrene insulation baffles with varying height heel.
 1. Width: Match spacing between roof framing members
 2. Length: 41 inches.
 3. Manufacturer: ADO; www.adoproducts.com
 - a. Model: ProVent Baffle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Coordinate the work with Section 07 25 05 - Building Wrap Weather Barriers
- B. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- C. Verify wood framing is dry with 15 percent maximum moisture content at time of insulation installation.
- D. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 INSTALLATION

- A. Install thermal protection in accordance with manufacture's written instructions.

3.03 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Adhere a 6 inches wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
 - 1. Tape seal joints.
- B. Install boards horizontally on foundation perimeter.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- D. Install Insulation Board Coating in accordance with manufacturer recommendations.

3.04 BATT INSTALLATION

- A. Install in exterior wall and ceiling spaces without gaps or voids. Do not compress insulation.
- B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation using spray foam insulation.
 - 1. Completely fill all stud and joist cavities enclosing supply or waste piping with mineral fiber insulation.
 - 2. Where such piping passes through a floor/ceiling cavity, fill the cavity with insulation to a minimum 18 inch horizontal distance beyond the pipe.
- D. Install with factory applied vapor retarder facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- E. Tape insulation batts in place.
- F. Ceiling Application: Retain insulation batts and vapor retarder in place with spindle fasteners at 12 inches on center.
- G. Tape tears or cuts in sheet vapor retarder.
- H. 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.
- I. Install sheet vapor retarder continuous at exterior walls, prestrip as required for intersecting elements such as interior walls tubs, etc.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

3.06 CLEANING AND PROTECTION

- A. Protect insulation from damage wear during construction period.
- B. Remove from jobsite refuse and debris and dispose of per Section 01 74 19.

END OF SECTION

SECTION 07 21 19
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
- B. Foamed-in-place insulation at junctions of dissimilar wall and roof materials to achieve a thermal and air seal.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- B. ASTM D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics 2017.
- C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- F. FM 4880 - Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials 2017.
- G. NFPA 275 - Standard Method of Fire Tests for the Evaluation of Thermal Barriers 2022.
- H. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.
- I. UL 1040 - Standard for Safety Fire Test of Insulated Wall Construction Current Edition, Including All Revisions.
- J. UL 1715 - Standard for Safety Fire Test of Interior Finish Material Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
 - 1. Hydrofluorocarbon (HFC) and Global Warming Potential (GWP): Provide letter from insulation manufacturer stating products provided to job site meet State and Federal regulations related to HFC and GWP for the project location.
- C. Certificates: Certify that products of this section meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

- E. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- F. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

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. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.05 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Foamed-In-Place Insulation (Closed cell):
 - 1. Basis of Design: Demilec; Product Heatlok HFO Pro; www.demilec.com.
 - 2. BASF Polyurethane Foam Enterprises LLC; Product Spraytite 178: www.basf.us.
 - 3. Icynene-Lapolla; Icynene ProSeal (MD-C-200 v3): www.icynene.com/#sle.
 - 4. Johns Manville; JM Corbond III Closed Cell Spray Polyurethane Foam: www.jm.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Foamed-In-Place Insulation: High-density, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and fire protection requirements.
 - a. Fire Protection: Provide 15-minute thermal barrier of 1/2 inch gypsum board or equivalent material complying with NFPA 275 test method, or foamed-in-place insulation either exposed or with covering that complies with FM 4880, NFPA 286, UL 1040, or UL 1715.
 - 2. Thermal Resistance: R-value of 7.4, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
 - 3. Water Vapor Permeance: Vapor retarder; 0.91 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
 - 4. Water Absorption: Less than 1 percent by volume, maximum, when tested in accordance with ASTM D2842.
 - 5. Tensile Strength: 44 psi per ASTM D1623.
 - 6. Closed Cell Content: At least 90 percent.

7. Surface Burning Characteristics: Flame spread/Smoke developed index of 15/350-400, maximum, when tested in accordance with ASTM E84.
8. Board Insulation to be Chlorofluorocarbon (CFC) free and meet the Global Warming Potentials requirements.

2.03 ACCESSORIES

- A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Apply to achieve a thermal resistance R-value as indicated on drawings.
- D. Patch damaged areas.

3.04 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.
- B. Protect insulation from damage wear during construction period.

3.05 CLEANING

- A. Remove from jobsite refuse and debris and dispose of per Section 01 74 19.

END OF SECTION

**SECTION 07 21 26
BLOWN INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Attic: Blown fiberglass insulation pneumatically placed into joist spaces.

1.02 REFERENCE STANDARDS

- A. 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.
- B. ASTM C764 - Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation 2019.
- C. ASTM C1015 - Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation 2017.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

1.03 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and limitations.
 - 1. Hydrofluorocarbon (HFC) and Global Warming Potential (GWP): Provide letter from insulation manufacturer stating products provided to job site meet State and Federal regulations related to HFC and GWP for the project location.

1.04 DOCUMENTATION FOR SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for site information:
 - 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - 2. Manufacturer's Installation Instructions: Indicate procedure for preparation and installation.
 - 3. Other types indicated.
- D. Documentation for Site Information maybe reviewed by Architect for reference.

1.05 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:

1. Project record documents.
 2. Operation and maintenance data.
 3. Submittals for Site information
 4. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Applications: Provide blown insulation in attic as indicated on drawings.
- B. Thermal Resistance [R-value]: Provided minimum values in accordance with applicable edition of ASHRAE Std 90.1 I-P for envelope requirements of building location and climate zone.
- C. Blown Insulation: ASTM C764, fiberglass type, bulk for pneumatic placement.
1. Thermal Transmittance (U-value): 0.27 BTU/hr sq ft deg F, maximum.
 2. Installed Thickness: As indicated on drawings.
 3. Thermal Resistance (R-value): As indicated on drawings.
 4. Combustibility: Rated non-combustible when tested in accordance with ASTM E136.
 5. Flame Spread = 5 and Smoke Developed = 5 when tested in accordance with ASTM E84.
 6. Manufacturer:
 - a. Basis of Design: CertainTeed Saint-Gobain; Product: InsulSafe SP.
www.certainteed.com
 - b. Owens Corning Insulating Systems, LLC; www.owenscorning.com
 - c. Johns Manville; www.jm.com
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Roof Ventilation Baffles: Prefabricated ventilation channels for placement under roof sheathing with baffles to prevent wind-washing.
1. Material: Polyvinyl chloride (PVC).
 2. Roof Joist/Truss Spacing: 16 inch on center, nominal.
 3. Manufacturers:
 - a. ADO; ProVent Baffle: www.adoproducts.com
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate and adjacent materials are dry and ready to receive insulation.
- B. Verify spaces are unobstructed to allow for proper placement of insulation.

3.02 INSTALLATION

- A. Install insulation and insulation baffle in accordance with ASTM C1015 and manufacturer's instructions.

- B. Place insulation pneumatically to completely fill truss space to a density to achieve R-Value indicated.
- C. Place insulation against baffles, and do not impede natural attic ventilation to soffit.
- D. Place against and behind mechanical and electrical services within the plane of insulation.
- E. Completely fill intended spaces leaving no gaps or voids.

3.03 CLEANING

- A. Remove loose insulation residue.
- B. Remove from jobsite refuse and debris and dispose of per Section 01 74 19.

END OF SECTION

**SECTION 07 25 05
BUILDING WRAP WEATHER BARRIERS (BWVB)**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building wrap weather barriers as air barrier.

1.02 REFERENCE STANDARDS

- A. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure 2018, with Editorial Revision (2019).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- D. ASTM E1677 - Standard Specification for Air Barrier (AB) Material or Assemblies for Low-Rise Framed Building Walls 2019.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
- F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

1.03 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Concept of connecting air impermeable materials to create a continuous separation of exterior air from interior air. Joints between air tight products are sealed air tight, See, Section 01 40 10 Air Barrier System, for degrees of air tightness.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. See Section 01 30 00 - Administrative Requirements, for pre-installation meeting procedures.
- B. Convene two weeks before starting work of this section.
 - 1. Notify attendees two (2) weeks prior to convening,
 - 2. Attendees to Include (minimum):
 - a. General Contractor.
 - b. Manufacturer and sub-contractor installing weather barrier system including membranes within openings.
 - c. Manufacturer and sub-contractor of windows and doors.
 - 3. Review details related to scope of work noted in this Section.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Test Results: Submit copies of test results showing performance characteristics equaling or exceeding those specified.
- E. Installer's Qualification Data.
 - 1. Installer Certificates: Signed by manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified system and has the qualifications noted in this Section under Quality Assurance and is eligible to receive standard manufacturer's warranty.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience and approved by manufacturer.

1.07 MOCK-UP

- A. See Section 01 43 39 - Free Standing Building Mockup for additional requirements.
- B. See Section 01 40 00 - Quality Requirements, for additional mock-up requirements.
- C. Construct mockup of wall and opening including glass and air barrier and vapor retarder seal.
- D. Locate where directed.
- E. Mockup may remain as part of the Work.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide 10 year manufacturer warranty for flashing and weather-resistive barrier systems.
 - 1. Manufacturer to pay for the cost of the materials and labor to completely resolve the problem.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide building wrap weather barriers from a single manufacturer.

2.02 MATERIALS

- A. Building Wrap Weather Barrier (BWWB): Spunbonded olefin, nonwoven, non-perforated, mechanically fastened homogeneous:
 - 1. Products:
 - a. Fortifber Building Systems Group; WeatherSmart Commercial; www.fortifber.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Classification: ASTM E1677, Type I; air leakage at 25 mph wind pressure less than 0.001 cubic feet per minute per square foot.
 - 3. Air Permeance: 0.003 cubic feet per square foot, maximum, when tested in accordance with ASTM E2178.

4. Water Vapor Transmission: Greater than 14 perms, when tested in accordance with ASTM E96/E96M, Procedure A.
5. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 6 months weather exposure.
6. Water Penetration Resistance: Minimum 280 cm per AATCC Test Method 127
7. Surfacing Burning Characteristics: ASTM E84, Class A, flame spread (10) and indexed smoke developed value (10).
8. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

2.03 ACCESSORIES

- A. Primers: As recommended by Manufacturer.
- B. Thinners and Cleaners: As recommended by material manufacturer.
- C. Self-Adhered Membrane Flashing: See Section 07 25 11.
- D. Basis of Design Building Wrap Tape: As recommended by Manufacturer.
 1. Tape Width: 3 inch.
- E. Foil Tape: As recommended by Manufacturer.
 1. Tape Width: 3 inch.
- F. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: See Section 07 92 00.
- G. Fasteners:
 1. Galvanized nails or screws with large heads or plastic washer heads.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install Building Wrap Weather Barrier in accordance with manufacturer's written installation instructions over exterior sheathing.
 1. Prepare window and door rough openings as specified in Section 07 25 11.
 - a. Install self-adhered membrane flashing around openings in walls, windows and doors rough openings after sheathing is installed
 - b. Install lower level barrier prior to upper layers to ensure proper shingling of layers.
 - c. Install foil tape on jamb and head as indicated on drawings to adhere caulk between wall and window.
 2. Install building wrap weather barrier after sheathing and flashing is installed, by a minimum of 12 inches for overlap.
 - a. Install windows and doors.
 - b. Overlap building wrap weather barrier vertical seams by a minimum of 12 inches and seal seam with wrap sealing tape.
 - c. Overlap building wrap weather barrier horizontal seams by a minimum of 6 inches on lower sheet and seal seam with wrap sealing tape.
 - d. Complete installation of building wrap weather barrier with siding installation.
- B. Attachment to framing:

1. Attach building wrap weather barrier to moisture resistant gypsum sheathing with plastic cap nails every 12 to 18 inches on vertical stud line with wood stud framing.
- C. Seal joints and penetrations through building wrap weather barriers with wrap sealing tape and fasteners before installation of finish material.
 1. Provide continuous sealant joint between building wrap weather barrier and sheathing where air barrier is to be transferred from exterior wall to interior ceiling at roof line or as indicated on drawings.
- D. Ensure that building wrap weather barriers are air tight, free from holes, tears, and punctures.
 1. Inside Corners: Fully formed to prevent tenting.
 2. Inside and Outside Corner Wrap: 6 inch strip of wrap sealing tape.
- E. Tape penetrations in accordance with manufacturer's instructions.

3.02 PROTECTION

- A. Protect membrane from damage and wear during construction period.
- B. Protect membrane from welding activities during construction period.

3.03 CLEANING

- A. Remove from jobsite refuse and debris and dispose of per Section 01 74 19.

END OF SECTION

SECTION 07 25 11
SELF-ADHERED MEMBRANE FLASHINGS (SAM-FLASHING)

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Self-adhered membrane flashing, strips. (SAM FLASHING)
- B. Foil faced self-adhered membrane flashing, strips. (SAM FLASHING - FF)
- C. High temperature self-adhered membrane flashing, strips. SAM FLASHING - HT)
- D. Below grade self-adhered membrane flashing, strips. (SAM FLASHING - BG)
- E. Through-wall self-adhered membrane flashing, strips. (SAM FLASHING - TW)
- F. Self-adhered membrane flashing, strips (SAM-FLASHING- UV)
- G. Accessories

1.02 REFERENCE STANDARDS

- A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension 2016 (Reapproved 2021).
- C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2017).
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).

1.03 ADMINISTRATIVE REQUIREMENTS

- A. See Section 01 30 00 - Administrative Requirements, for pre-installation meeting procedures.
- B. 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.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Manufacturer's specifications and other data needed to show compliance with specified requirements.
 - 2. Tested physical and performance properties of waterproofing, including compliance with limits on VOC emissions.
 - 3. Manufacturer's installation instructions.
 - 4. Product data sheets for products supplied under this Section including primers and accessory detailing compounds.
- C. Shop Drawings:

1. Show locations and extent of membranes and membrane flashings on project specific details.
 2. Include details at penetrations, and termination conditions including at adjoining construction that are project specific.
- D. Test Reports:
1. Product test reports from an independent Testing Agency.
- E. Certifications:
1. Installer certificate signed by manufacturer certifying installer has been trained and approved by manufacturer to install specified product.
 2. Manufacturers Certificates indicating adhesive and chemical compatibility with adjacent and accessory products specified herein or in other Sections including but not limited to Sheathing, Pedestrian Traffic Coatings, and Joint Sealers.

1.05 QUALITY ASSURANCE

- A. Installer:
1. Engage an applicator currently approved in writing by membrane manufacturer.
 2. Membrane Manufacturer Qualifications: Company specializing in waterproofing self-adhered membranes with ten years experience.
 3. Installer Qualifications: Company specializing in performing work of this Section with minimum five years experience and who has successfully completed a minimum of 3 projects of similar size, quality and complexity.
 - a. Installer to be currently approved in writing by membrane manufacturer.
 4. Coordinate as required with other trades interfacing with Work of this Section to ensure proper and adequate provision for preceding or sequential Work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to jobsite in manufacturer's original packaging, with labels intact and legible.
- B. Storage:
1. Maintain packaging, seals and labels intact until time of use.
 2. Store materials off ground and protected from damage, including that resulting from exposure to direct sunlight.
 3. Store roll materials on end.

1.07 FIELD CONDITIONS

- A. Do not install primer or membrane when temperature is below 41 degrees F.
1. Use cold weather products when application is between 25 and 41 degrees F per manufacturer's written instructions.
 2. Do not install product below 25 degrees F.
- B. Do not install membrane in standing water, during wet or damp weather, or on wet, damp or frost covered substrates.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Special Manufacturer's Warranty:
 - 1. Written warranty, signed by membrane manufacturer, agreeing to replace membrane material that does not comply with requirements or that does not remain water, air and vapor tight during specified warranty period.
 - 2. Warranty does not include failure of membrane due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
- D. Special Installer's Warranty: Written membrane Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two (2) years.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Self-adhered membrane flashing to make exterior walls and joints between exterior walls water vapor-resistant and air-tight.
 - 1. Membrane to prevent passage of water, air infiltration, vapor diffusion and complies with requirements as demonstrated by mock-up testing by independent Testing Agency of manufacturer's membrane.
- B. Environmental Characteristics:
 - 1. Comply with State VOC requirements or no VOC content, no formaldehyde content, are water-based rather than solvent-based, and are certified to not off-gas.
 - 2. Comply with Code of Federal Regulations Chapter 40, articles 59.400 – 59.413 governing VOC emissions for architectural coatings.

2.02 MATERIALS

- A. Self-Adhered Membrane Flashing (SAM FLASHING):
 - 1. Self-adhered membrane over exterior wall sheathing opening penetrations and as indicated.
 - 2. General:
 - a. HDPE faced, asphalt-butyl hybrid, self-adhesive membrane.
 - b. Thickness: 40 mils, excludes removable release film protecting adhesive surface.
 - c. Tested and shown to resist softening, flow, or deterioration of temperatures between 14 and 150 deg F.
 - 3. Products:
 - a. Basis of Design: Protecto Wrap; Product: PW-100/40 Air/Vapor Barrier; www.protectowrap.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Below-grade Self-Adhered Membrane Flashing (SAM FLASHING - BG):
 - 1. Self-adhered membrane below grade, penetrations and as indicated.
 - 2. General:
 - a. Reinforced polyethylene-faced, butyl based rubberized, self-adhesive membrane.
 - b. Thickness: 60 mils, excludes removable release film protecting adhesive surface.

- c. Tested and shown to resist softening, flow, or deterioration of temperatures between 14 and 150 deg F.
 3. Products:
 - a. Basis of Design: Protecto Wrap; Product: PW-100/60; www.protectowrap.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - C. Foil-faced Self-Adhered Membrane (SAM FLASHING - FF):
 1. Use where sealant required to adhere to membrane.
 2. General:
 - a. Aluminum foil-faced, butyl based rubberized, self-adhesive membrane.
 - b. Thickness: Minimum 45 mils. excludes removable release film protecting adhesive surface.
 - c. Tested and shown to resist softening, flow, or deterioration at temperatures up to 300 deg F.
 3. Products:
 - a. Basis of Design: Protecto Wrap; Product: PS-45 Butyl; www.protectowrap.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - D. High-temperature Self-Adhered Membrane Flashing (SAM FLASHING - HT):
 1. Provide membrane flashing where sealant to membrane not required, under sheet metal flashings and copings, metal roofing and siding including mechanical penthouse siding and roof and as indicated:
 2. General:
 - a. Reinforced polyethylene-faced, butyl based rubberized, self-adhesive membrane.
 - b. Thickness: 45 mils minimum, excludes removable release film protecting adhesive surface.
 - c. Tested and shown to resist softening, flow, or deterioration at temperatures up to 300 deg F.
 3. Products:
 - a. Basis of Design: Protecto Wrap; Product: PS-45 Butyl; www.protectowrap.com
 - b. Grace Construction Products: Grace Ultra; www.grace.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - E. Through-Wall Self-Adhered Membrane Flashing (SAM FLASHING - TW):
 1. Cross-laminated high-density polyethylene (HDPE) film laminated to an aluminum foil facing, conforming to the following:
 - a. Minimum thickness: 45 mils.
 - b. Adhesive: High temperature butyl.
 - c. Tensile strength: 400 psi when tested in accordance with ASTM D412.
 - d. Peel strength: 40 psi when tested in accordance with ASTM D903.
 - e. Elongation: Minimum of 225% when tested in accordance with ASTM D412.
 - f. Nail sealability: Pass per ASTM D1970/D1970M.
 - g. Vapor permeance: <.05 when tested in accordance with ASTM E96/E96M.
 2. Manufacturer:
 - a. Basis of Design: ProtectoWrap Company; Product - Protecto SafSeal 45 Butyl. www.protectowrap.com

- b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Self-Adhered Membrane Flashing (SAM FLASHING-UV):
- 1. Self-adhered membrane over exterior walls as indicated.
 - 2. General:
 - a. Self-adhesive vapor permeable air and water-resistive barrier, highly tear-resistant membrane, with non-woven polypropylene (PP) fabric, UV stable acrylic coating, and highly aggressive adhesive coating on the back.
 - b. Water vapor permeability: Minimum 50 perms when tested in accord with ASTM E96/E96M. Procedure B.
 - c. Liquid Flasing and Sealants: Use 100% Silicone.
 - 3. Products:
 - a. Basis of Design: Dörken Systems Inc., DELTA -FASSADE SA.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

- A. Preformed Penetration Flashing:
- 1. System Description:
 - a. Flashing panels to weatherproof building penetrations, plumbing and electrical penetrations in exterior walls.
 - 2. Products: Types as to fit application.
 - a. Mechanical and Plumbing Flashing Panels:
 - 1) Materials: Combination of high-density polyethylene (HDPE) and low-density polyethylene (LDPE).
 - b. Electrical Flashing Panels:
 - 1) Material: Thermoplastic elastomer.
 - 3. Manufacturer:
 - a. Quickflash Weatherproofing Products, Inc.;; www.quickflashproducts.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 SEALANTS

- A. Silicone Sealant: As specified in Section 07 92 00.
- B. Sealant Backers: As specified in Section 07 92 00.
- C. Primers, Cleaners, and Other Sealant Materials: As recommended by sealant manufacturer, appropriate to application, and compatible with adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Applicator to examine areas and conditions under which Work of this Section will be performed.
- 1. Verify conformance with Manufacturers requirements.
 - 2. Report unsatisfactory conditions in writing to Architect.
 - 3. Do not proceed until unsatisfactory conditions are corrected.

- a. Coordinate with other trades to assure proper and adequate interface with Work of this Section.
- b. Verify items that penetrate sheathing surfaces are securely installed prior to membrane application.

3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive membrane.
- B. Moisture Resistant Gypsum Sheathing and Framing Substrates:
 1. Ensure that fasteners are fully driven and do not protrude beyond face of sheathing or framing.
 2. Ensure sharp metal edges are rounded or smoothed-off to prevent puncture of membrane.
 3. Verify that adjacent sheathing sheets and framing are installed without differential offset of greater than 1/8 inch.
 4. Gaps between sheathing sheets, framing or penetrations exceeding 1/8 inch to be filled with spray foam or silicone sealant to provide continuous substrate.
 - a. Apply sealant acceptable to sheathing Manufacturer.
 5. Sheathing which has been damaged or where gypsum core is fractured to be replaced.
- C. Do not apply membrane to surfaces unacceptable to manufacturer or applicator.
- D. Surface Primer:
 1. Apply surface primer to substrates and at rate recommended by manufacturer such that substrate is uniformly coated.
 2. Mask and protect adjoining exposed finish surfaces to protect from excessive application of surface primer.
 3. Allow surface primer to dry completely prior to installation of membrane.
 4. Cure time will vary with weather conditions.
 - a. Do not apply surface primer to areas which will not be covered with membrane in same day.
 - b. Recoat areas not covered with membrane after twelve (12) hours or if contaminated by dust.
- E. Detailing:
 1. Apply bed of detailing compound at perimeter conditions.
 2. Apply bed of detailing compound around penetrations, wall jacks.
 3. Install detail strips of membrane as indicated in Drawings or at opening penetrations or material transitions.
 4. Utilize hand roller to ensure full contact adhesion of membrane materials.
 5. Install flashings and sealants at opening penetrations as indicated in Drawings or as required by manufacturer.
 6. Apply sill drainage mesh under sill at flanged windows, cut to window width. Secure with sealant or staples.

3.03 INSTALLATION

- A. Install system per manufacturer's written installation instructions, except where more rigorous requirements are contained herein.
 - 1. Roll out membrane. Discard wrinkled or bubbled material.
 - 2. Sequence membranes to allow tie-in to openings and transitions.
- B. Lap each sheet or strip in watershedding manner with upper sheets over lapping lower sheets in horizontal fashion.
- C. Sheets and strips to be rolled with hand roller to ensure complete and even adhesion. Air pockets, fishmouths or unadhered areas of membrane to be cut out and repaired.
 - 1. Provide 3 inch, minimum, wide strips at furring, where indicated.
- D. Laps: Minimum of 3 inches, unless otherwise noted or required by manufacturer.
 - 1. Wipe down scrim material at each overlap area using two rag alcohol wipe method to remove dust or contaminants prior to installing successive sheets or strips.
 - 2. Roll each lap with hand roller to ensure full and complete adhesion.
 - 3. Detail each exposed edge with detailing compound within one day of installation.
- E. Detail around clips and metal ties. Set clips and metal ties in full bed of sealant on SAM flashing patch.
 - 1. Membrane not to be exposed to ultraviolet light (sunlight) for longer than 30 days or as established in manufacturer's written literature, whichever is more stringent.

3.04 REPAIR

- A. Where damaged, a repair patch of like membrane may be installed.
 - 1. Cut out damage membrane, clean scrim surface around patch area with a two rag alcohol wipe, and apply a patch of material extending six inches around edge of damaged area.
 - 2. Roll seams tight with a hand roller and detail edges with detailing compound.
 - 3. Seal leading edge of patch with mastic.

3.05 PROTECTION

- A. Protect membrane from damage and wear during construction period.
- B. Protect membrane from welding activities during construction period.

3.06 CLEANING

- A. Clean spillage and soiling from adjacent construction. Remove from jobsite refuse and debris and dispose of per Section 01 74 19.

END OF SECTION

SECTION 07 31 15
FIBERGLASS REINFORCED SHINGLES (FRS)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shingles as indicated on drawings.
- B. Leak Barrier.
- C. Roofing Underlayment.

1.02 REFERENCE STANDARDS

- A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017 (Reapproved 2023).
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- C. ASTM D2822/D2822M - Standard Specification for Asphalt Roof Cement, Asbestos-Containing 2005 (Reapproved 2011).
- D. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method) 2020.
- E. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules 2019.
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- G. ASTM D7158/D7158M - Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method) 2020.
- H. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2017).
- I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- J. NRCA (RM) - The NRCA Roofing Manual 2023.
- K. UL (RMSD) - Roofing Materials and Systems Directory current edition.

1.03 SYSTEM DESCRIPTION

- A. Fiberglass reinforced shingles; site installed, for installation over underlayment, high temperature self-adhered membrane and wood substrate.

1.04 PERFORMANCE REQUIREMENTS

- A. Components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall; and vertical live and dead loads as calculated in accordance with Building code.
 - 1. Maximum allowable deflection of roofing: L/240.
 - 2. Vertical live and dead loads: As indicated on drawings.

3. Design Wind Pressure: 20 PSF positive and negative, minimum.
- B. Design fastener system to provide for movement of components without damage, undue stress on fasteners, or other detrimental effects when subject to Design Wind Pressure and thermal movement.
- C. System to accommodate, without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- D. Products of this Section, and related Sections, shall provide continuity of weather barrier at building enclosure elements.
- E. Comply with ASTM D7158/D7158M and ASTM D3161/D3161M for maximum basic wind speed

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.
 1. Including data that materials comply with requirements.
- C. Test Reports: Show compliance with ASTM D3161/D3161M and ASTM D7158/D7158M.
- D. Shop Drawings: For metal flashings, indicate specially configured metal flashings, jointing methods and locations, and fastening methods and locations.
- E. Samples:
 1. Submit full range of samples for color and texture selection.
 2. After selection, submit two full-size samples of each shingle color indicating color range and finish texture/pattern .
- F. Provide calculations for loadings and stresses of fasteners, stamped by a Professional Engineer or applicable model code authority evaluation report (e.g. ICC-ES).
- G. Manufacturer's Instructions: Indicate installation criteria and procedures.
- H. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 1. Certify that products meet or exceed specified requirements.
 2. Installer is certified by manufacturer for work of this section.

1.06 QUALITY ASSURANCE

- A. UL (RMSD) Listing:
 1. Provide labeled materials which have been tested and listed by UL for Class and Rating indicated for each shingle type required.
- B. Installer shall have successfully and recently complete a minimum of 3 projects of similar size, quality and complexity and approved by manufacturer.
- C. Coordinate with other trades to assure proper and adequate provision in work of those trades for interfacing with work of this Section.
- D. Comply with OSHA requirements during installation.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's unopened, labeled bundles, rolls or containers.
- B. Store materials to avoid water damage, and store rolled goods on end.
 - 1. Comply with manufacturer's recommendations for job-site storage and protection.
- C. Do not overload buildings structural system by stacking bundles in concentrated locations.

1.08 JOB CONDITIONS

- A. Substrate:
 - 1. Proceed with shingle work only after substrate construction and penetrating work have been completed.
- B. Weather Conditions:
 - 1. Proceed with shingle work only when weather conditions are in compliance with manufacturer's recommendations and when substrate is completely dry.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 2 years period after Date of Substantial Completion.
 - 1. Repair and/or replace without additional cost to Owner any water leaks and resulting damage to building materials and/or building contents as may occur under normal usage within Warranty Period.
- C. Standard Product Limited Warranty: 5 year Tru Protection period Labor and materials covered for manufacturer defect, excludes tear off or disposal fees. Year 6 begins pro-rated material only.
- D. Manufacturer's 40 year warranty covering defective materials for shingle assembly.
- E. High Wind Warranty: 130 mph.

1.10 CERTIFICATION

- A. Prior to commencement of work, submit Manufacturer's certification letter stating that requirements of Contract Documents have been met or exceeded, and that installer is approved by shingle Manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: Owens Corning Corp; Product: Trudefinition Duration; www.owenscorning.com.
- B. Other Acceptable Manufacturers:
 - 1. Certaineed Corp: www.certainteed.com
 - 2. GAF Materials Corporation: www.gaf.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Three-Dimensional, Fiberglass, Laminated Asphalt Shingles:
 - 1. Mineral-surfaced, self-sealing, laminated, multi-ply overlay construction, fiberglass-based, strip asphalt shingles, with fungus/ algae resistance, complying with ASTM D3462/D3462M.
 - 2. Fire Resistance: Class A
 - 3. Wind Resistance: Class F, when tested in accordance with ASTM D3161/D3161M.
 - 4. Warranted Wind Speed: Not less than tested wind resistance.
 - 5. Nominal Dimensions: 13 1/4 inches by 39 3/8 inches.
 - 6. Color: As selected.
- B. Starter Strip: Two piece perforated strip shingle.
 - 1. Material: Matches standard shingle.
 - 2. Nominal Dimensions: 13 1/4 inches by 39 3/8 inches.
 - a. Piece Size: 6 5/8 inches by 39 3/8 inches.
- C. Roofing Underlayment:
 - 1. Basis of Design: Owens Corning; Product: Pro-Armor, Synthetic Underlayment, complying with ASTM D226/D226M; Type II, 42 inches wide minimum.
 - 2. GAF - Deck Armor; Synthetic Underlayment, complying with ASTM D226/D226M; Type II, 48 inches wide minimum.
 - 3. Certainteed - Product: Diamond Deck, Synthetic Underlayment, complying with ASTM D226/D226M ; Type II, 48 inches wide minimum.
 - 4. Vapor Permeance: Minimum 1 perms when tested in accordance with ASTM E96/E96M, Wet Cup Method B.
- D. Leak Barrier:
 - 1. Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.
 - 2. Application: Eaves, edges and valleys.
 - 3. Width: 36 inches
 - 4. Service temperature: 250F minimum.
 - 5. Adhesion: 75F per ASTM D903, min. 12 lb/ft-width.
 - 6. Manufacturers:
 - a. Basis of Design: Owens Corning; Product Weatherlock specialty tile and metal.
 - b. Grace Construction Products; Product Grace Ice & Water Shield HT.
 - c. Certainteed; Product WinterGuard HT.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Plastic Cement: ASTM D4586/D4586M, asphalt roof cement.
- F. Lap Cement: ASTM D2822/D2822M, Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents, designed for trowel application.
- G. Hip and Ridge Shingles:
 - 1. Pre-scored hip & ridge shingles.
- H. Nails:

1. Aluminum or hot-dip galvanized 11 or 12-gauge, sharp-pointed, conventional roofing nails with barbed shanks.
 2. Minimum 3/8 inch diameter head, and of sufficient length to penetrate 3/4 inch into solid decking or to penetrate through plywood sheathing.
- I. Staples:
1. Minimum 16-gauge zinc-coated steel roofing staples with minimum crown width of 15/16 inch and of sufficient length to penetrate 3/4 inch into deck lumber or through plywood deck.
- J. Metal Drip Edge:
1. Minimum 0.025 inch prefinished aluminum sheet, brake-formed to provide 6 inches roof deck flange, and 5 inch fascia flange with 1 inch drip at lower edge.
 2. Furnish in 8 foot or 10 foot lengths.
- K. Metal Flashing:
1. Material: 24 gauge prefinished galvanized steel
 2. Prefinish: Kynar 500.
 3. Job-cut to sizes and configurations required.
- L. Pipe Penetration Flashing:
1. Product: Lifetime tool ultimate pipe flashing.
 2. Finish: Kynar coated, silicone gasket to pipe 24 ga galv.
- M. Linear Ridge Vent:
1. Free Area: 18 sq. inches net vent area per lineal foot.
 2. Manufacturers
 - a. Basis of Design: GAF: Snow Country Advanced; www.gaf.com
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- N. Roof Intake Vents:
1. Basis of Design: The Edge Vent, by Airvent; www.airvent.com.
 - a. Size: See drawings.
 - b. Color: Black.
 - c. Vent Area: 9 sq. in. net free area per linear foot.
 2. Product: Lomanco Inc.; Deck-Air Intake Vent; www.lomanco.com.
 3. Product: CertainTeed Corporation; Intake Vent.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- O. Soffit Edge Vent:
1. Product: Cobra Master Flow LSV8 Series by GAF.
 2. Product: Lomanco Continuous Soffit Vents Model 105; www.lomanco.com.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- P. Roof Louver:
1. Product: Master Flow Louver, Model: SSB960G by GAF; www.gaf.com.
 2. Construction: Galvanized.
 3. Color: Black.
 4. Net Free Area: 60 sq. in.
 5. Opening Size: 10 inches.
 6. Dimensions: 16 inches wide by 5 1/2 inches high.

- 7. Options: Provide weather filter.
- Q. Provide other materials, not specifically described but required for a complete and proper installation.
- R. Roof Sheathing: See Section 06 10 00 - Rough Carpentry.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate and conditions under which Work of this Section is to be performed and notify Architect in writing of unsatisfactory conditions.
 - 1. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Verify that substrate is sound, dry, properly sloped for drainage, and completely secured in position.
- C. Verify that provision has been made for roof drains, gutters, scuppers, flashing, vents, and other interface items attaching to or penetrating through work of this Section.
- D. As necessary, protect work of others from damage.

3.02 PREPARATION OF SUBSTRATE

- A. Clean substrate of any projections and substances detrimental to shingling work.
 - 1. Cover knotholes or other minor voids in substrate with sheet metal flashing secured with roofing nails.
- B. Coordinate installation of shingles with flashing and other adjoining work to ensure proper sequencing.
 - 1. Do not install shingle roofing until vent stacks and other penetrations through roofing have been installed and are securely fastened against movement.

3.03 INSTALLATION

- A. Install Work of this Section in accordance with:
 - 1. Construction documents.
 - 2. Requirements or governmental agencies having jurisdiction.
 - 3. Manufacturer's and referenced standards recommended installation procedures, required for specified warranty.
 - 4. Anchor components firmly into position for a completely weathertight installation and as required to receive specified warranty.
- B. Roofing Underlayment:
 - 1. Install Roofing Underlayment over entire roof in accordance with manufacturer's recommendations.
 - a. Weather lap plies and end joints as recommended.
 - b. Stagger end joints of each consecutive ply.
- C. Leak Barrier:
 - 1. Install leak barrier at eaves, ridges, penetrations, and valleys in accordance with manufacturer's written installation instructions.
 - a. Weather lap plies and end joints as recommended.

- b. Stagger end joints of each consecutive ply.
- 2. Extend leak barrier minimum 3 feet up slope beyond interior face of wall.
- D. Flashing and Edge Protection:
 - 1. Install metal flashing, vent flashing and Roofing underlayment as indicated and in compliance with details and recommendations of NRCA (RM).
 - 2. Place eave edge, valley, and rake edge metal flashings tight with fascia material. Weather lap joints 4 inches and seal with plastic cement. Secure deck flange with nails spaced 12 inches o.c., staggered.
- E. Starter Strip: Set in continuous bead of sealant.
- F. Shingles:
 - 1. Install starter strip of roll roofing or inverted shingles with tabs removed; fasten shingles in pattern, weather exposure and number of fasteners per shingle as recommended by manufacturer.
 - 2. Use horizontal and vertical chalk lines to ensure straight coursing.
 - 3. Comply with installation details and recommendations of shingle manufacturer and NRCA (RM).

3.04 CLEANING

- A. Clean, without damaging, exposed surfaces affected by work of this Section, and repair as necessary; remove from jobsite refuse and debris created by this work and dispose of in a legal manner.
- B. Remove excess and cut shingles and roof installation debris from project site per Section 01 74 19.

3.05 PROTECTION

- A. Do not permit unnecessary walking on finished roof; require personnel to wear rubber-soled shoes when walking on finished roof.

END OF SECTION

**SECTION 07 41 13
METAL ROOF PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural standing seam roofing system of preformed steel panels.
- B. Attachment system.
- C. Finishes.
- D. Accessories.

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. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- 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 A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2022.
- F. ASTM D3767 - Standard Practice for Rubber - Measurement of Dimensions 2014.
- G. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension 2016 (Reapproved 2021).
- H. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2017).
- I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- J. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference 2005 (Reapproved 2017).
- K. FM 4474 - Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures 2010.
- L. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems 2018.
- M. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc. Current Edition, Including All Revisions.
- N. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies Current Edition, Including All Revisions.

1.03 SYSTEM DESCRIPTION

- A. Preformed and prefinished roof panels; site assembled.
- B. System shall have been tested and found to be in compliance with FM 4474, UL 580, or UL 1897

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Summary of test results, indicating compliance with specified requirements.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Hydrofluorocarbon (HFC) and Global Warming Potential (GWP): Provide letter from insulation manufacturer stating products provided to job site meet State and Federal regulations related to HFC and GWP for the Extruded Polystyrene (XPS) or Polyisocyanurate (ISO) Insulation.
- C. Assembly Data: Provide Stamped engineered calculations licensed in the State the project is located, indicating roof assembly meets higher of either, Building Code or Owner's building insurance required values for wind uplift.
- D. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.
 - 2. Include structural analysis signed and sealed by qualified structural engineer, indicating compliance of roofing system to specified loading conditions.
 - a. Provide calculations for loadings and stresses of fasteners.
 - b. Provide compliance with ANSI/SPRI/FM 4435/ES-1.
- E. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available standard colors and patterns.
- F. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
- G. Manufacturer's qualification statement.
 - 1. Provide documentation that indicates manufacturer is accredited under IAS AC472.
- H. Installer's Qualification Statement.
- I. Test Reports: Submit test report showing assembly matching project design and meeting the performance requirements indicated below.
- J. Warranty: Submit specified manufacturer's sample warranty as specified herein.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project, with not less than 25 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience of similar projects type and size, and approved by manufacturer.

1. Provide list of projects of like type and size.
 2. Bond capacity: Provide bond in amount equal to this scope of work and with no outstanding claims or actions.
- C. Source Limitations: Obtain all components of the proposed roofing system from a single manufacturer including all flat stock material as defined in sheet metal flashing and trim.
1. All pre-finished mechanical fasteners of any type shall be provided by the same manufacturer as supplied the panels in order to maintain a congruent paint finish, color, and paint warranty.
 2. The use of different pre-finished mechanical fasteners will invalidate the paint warranty.
- D. Manufacturers Inspections: Direct manufacturer representative shall inspect the project via an on-site inspection in order to provide a weathertight warranty.
- E. Factory roll formed panels: All panels must be factory roll formed and pre-manufactured. On site manufacturing is unacceptable.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of twenty years from Date of Substantial Completion.
- C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of twenty years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Roof Panels:
1. Morin Corporation; Symmetry Roof Systems: www.morincorp.com/#sle.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
 2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.

3. Wind resistance to meet:
 - a. Comply with UL 580, UL 1897 or FM 4474, Wind Loads to Roof Systems and Roof Deck Securement.
 - b. Comply with ANSI/SPRI/FM 4435/ES-1 for edge systems and coping securement.
4. Wind Design Criteria: As indicated on structural drawings.
 - a. Designed to withstand wind uplift forces calculated with ASCE 7.
5. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.03 ARCHITECTURAL METAL ROOF PANELS

- A. Architectural Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Architectural Metal Panels: Factory-formed panels with factory-applied finish.
 1. Steel Panels:
 - a. Zinc-coated steel complying with ASTM A653/A653M; minimum G90 galvanizing.
 - b. (Galvalume) Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.
 - c. Steel Thickness: Minimum 24 gauge (0.0276 inch).
 2. Profile: Standing seam, with minimum 1.5 inch seam height; concealed fastener system lapped seam in standing seam profile.
 3. Texture: Smooth.
 4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
 5. Width: Maximum panel coverage of 12 inches.

2.04 ATTACHMENT SYSTEM

- A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.
 1. Fastener Clip:
 - a. Thermal Movement: 1 inch.
 - b. UL 90 rated, 18 gauge stainless steel, 40 ksi yield strength, 3 inch long triple fastener type.
 2. Fasteners: As recommended by Manufacturer for design loads.

2.05 FABRICATION

- A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

2.06 FINISHES

- A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF)

resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss to match sample.

- B. Interior Finish:
 - 1. Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils; finish coat material: polyester paint, finish coat dry film thickness: 0.35 mils.
 - 2. Total Interior Dry Film Thickness: 0.50 mils.
 - 3. Color: Off-White.

2.07 ACCESSORIES

- A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
- B. Rib, Ridge Closures, and Fascias: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
- C. Sealants:
 - 1. Exposed Sealant: Silicone.
 - 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
 - 3. Tape Seam Sealant: Factory-applied, non-skinning, non-drying type.
- D. High Temperature Underlayment:
 - 1. High Temperature Self-Adhered Membrane conforming to the following:
 - a. High density cross laminated polyethylene film backed by a layer of butyl rubber adhesive.
 - b. Thickness: 30 mils when measured in accordance ASTM D3767.
 - c. Tensile Strength: 250 psi when tested in accordance with ASTM D412 (Die C modified)
 - d. Elongation: 250% when measured in accordance with ASTM D412 (Die C modified).
 - e. Adhesion to plywood: 3.0 lbs/in with when tested in accordance with ASTM D903.
 - f. Maximum Permeance: 0.05 Perms when tested in accordance with ASTM E96/E96M
 - g. Roll width: 34 inches.
 - 2. Manufacturer:
 - a. Basis of Design: Grace Construction Products, Inc.; Product - Ice and Water Shield Ultra. www.gcpat.com
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's written instructions and recommendations, as applicable to specific project conditions, minimizing transverse joints except at junction with penetrations. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
 - 1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
 - 2. Form weathertight standing seams incorporating concealed clips, using an mechanical seaming device approved by the panel manufacturer.
 - 3. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
 - 4. Provide sealant tape or other approved joint sealer at lapped panel joints.
- B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
- C. High Temp Self-Adhered Membrane Underlayment:
 - 1. Install underlayment over entire roof and 12 inches up vertical surfaces next to roof.
- D. Panels and Trim: Comply with manufacturer's written instructions for assembly, installation and erection for weather tight installation.
 - 1. Form seams with manufacturer-approved motorized seaming tool; completely engage panel, clip, and factory-applied sealant in seam.
 - 2. Comply with methods and recommendations of SMACNA Architectural Sheet Metal Manual for flashing configurations required.
 - 3. Discrepancies between job site conditions and shop drawings shall be brought to the attention of the Architect for resolution.
 - 4. Cutting and Fitting:
 - a. Cut panels neat, square, and true with shearing action cutters. Torch or power saw cutting is prohibited.
 - b. Openings 6 inches and larger: Shop fabricate and reinforce to maintain original load capacity.
 - c. Openings less than 6 inches: Field cutting is acceptable.
 - 5. Dissimilar Metals or Materials:
 - a. Where panel or trim may come in contact with dissimilar metals or treated lumber, fabricate transition to facilitate drainage and minimize possibility of galvanic action. Galvanic action can cause panels and trim to fail prematurely.
 - b. At points of contact with dissimilar metal or treated lumber, coat panel and trim with protective paint or separate materials with a weatherproof underlayment.
 - c. Direct contact or run-off from CCA, ACQ, CA, or other treated lumber (outdoor wood) or fire retardant impregnated or treated wood shakes or siding can cause panels and trim to fail prematurely. Avoid contact with these materials.
 - 6. Accessories: Install trims, flashings, and roofing specialties according to Drawings and manufacturer's recommended details.

7. Sealant Installation: Apply according to approved shop drawings and SMACNA Architectural Sheet Metal Manual recommendations.

3.03 CLEANING

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.04 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.
- C. After completing installation, remove and recycle debris excess materials and debris from project site per Section 01 74 19.

END OF SECTION

**SECTION 07 42 13
METAL WALL PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concealed fastener single-skin metal wall panels installed using the back ventilated rainscreen design principle
- B. Accessories including fasteners, perimeter trim and penetration treatments.

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 A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2022.

1.03 SYSTEM DESCRIPTION

- A. Preformed and prefinished siding; site assembled, on furring channels for installation over sheathed walls with weather barrier.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
 - 1. Physical characteristics of components shown on shop drawings.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions and recommendations.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
 - 1. Indicate component details and anchorage.
 - 2. Location and type of sealants.
 - 3. Installation sequence
 - 4. Provide stamp on shop drawings from design engineer licensed in state project is located.
 - 5. Provide stamp on calculations for loadings and stresses of fasteners and wind resistance per Code and Structural Criteria from design engineer licensed in state project is located.
- D. Samples: Submit two samples of wall panel, 12 inches by 10 inches long in size illustrating finish color, sheen, and texture.
- E. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience and approved by manufacturer.

1.06 MOCK-UPS

- A. Construct mock-up, 4 feet long by 6 feet wide; include panel and soffit system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, and related insulation in mock-up.
- B. Locate as directed by Architect.
- C. Mock-up may remain as part of work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.
- C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.
- D. Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214, Method A, and /or color fading in excess of 5 ΔE Hunter units on panels when tested in accordance with ASTM D2244.
 - 1. Warranty Period: Twenty (20) years from date Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Wall Panels - Concealed Fasteners:
 - 1. Morin Corporation; Matrix Series MX 6.0: www.morincorp.com.

2.02 PERFORMANCE REQUIREMENTS

- A. Components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, as calculated in accordance with Building code.
 - 1. Design Wind Pressure: As indicated on structural drawings.
- B. Design fasteners system to provide for movement of components without damage, undue stress on fasteners, or other detrimental effects when subject to Design Wind Pressure and thermal movement.

- C. Maximum Allowable Deflection of Panel: $1/90$ at center of span.
- D. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
- E. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

2.03 METAL WALL PANEL MATERIALS

- A. Wall Panel System: Factory fabricated prefinished metal panel system site assembled.
 - 1. Provide exterior wall panels, interior liner panels, and subgirt framing assembly.
 - 2. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
 - 3. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.
- B. Exterior Wall Panels:
 - 1. Profile: Vertical; MX 6.0 style.
 - 2. Material: Precoated steel sheet, 20 gauge, 0.0359 inch minimum thickness.
 - 3. Panel Width: 12 inches.
 - 4. Panel Thickness: 1-1/2 inch.
 - 5. Panel Joint: Tongue and groove interlock joint
 - 6. Texture: Smooth.
 - 7. Color: As indicated on drawings.
- C. Subgirt Framing Assembly:
 - 1. Hat channel profile and specified in Section 05 40 10; to attach panel system to building.
 - a. Shims: Provide shims at horizontal furring conditions.
- D. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.04 MATERIALS

- A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.
- B. Interior Finish Coating: Panel manufacturer's standard polyester top coat, over recommended primer.

2.05 FINISHES

- A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss to match sample.

2.06 ACCESSORIES

- A. Wall panel accessories: Provide accessories as required for a complete installation. Accessories shall be as indicated on approved shop drawings and per manufacturer's approved standard details. Match material and finish of metal wall panels.
 - 1. Closure Strips:
 - a. Closed Cell Closure Strips: Provide minimum 1 inch thick matching metal wall panel profile.
 - b. Metal Profile Closure Strips: Shall be fabricated from same gauge, material and finish as metal panel.
 - 2. Concealed Clip and Fastener:
 - a. Product: MIP Seris Clip by Morin.
- B. Trim:
 - 1. Fabricate trim from same material and material thickness as wall panels. Finish to match metal wall panels.
 - 2. Locations include, but are not limited to the following: Drips, sills, jambs, corners, framed openings, parapet caps, reveals and fillers.
- C. Isolation Tape: Vinyl medium adhesion cleanroom tape.
 - 1. Application: Continuous outside face of girts. Isolate girt and metal panel from corrosion.
 - 2. Products:
 - a. UltraTape; UltraTape 1160: www.cleanroomtape.com.
- D. Insect Baffle: See Section 07 62 00 - Sheet Metal Flashing and Trim.
- E. Sealants: As specified in Section 07 92 00.
- F. Fasteners: Manufacturer's standard type to suit application; steel, hot dip galvanized.
- G. Field Touch-up Paint: As recommended by panel manufacturer.
- H. Weather Barriers: See Section 07 25 05 - Building Wrap Weather Barriers.
- I. Self-Adhered Membrane Flashing: See Section 07 25 11.
- J. Isolation Tape:
 - 1. Application: Continuous on outside face of girts with protean metal wall panels applied to isolation girt and metal panel from corrosion.

2.07 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest practicable lengths.
- C. Metal wall panels shall be formed to lap and interconnect with edges of adjacent panels.
- D. Fabricate metal wall panels to eliminate condensation on interior side of panel and with joints between panels designed to form weathertight seals.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION

- A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.
- B. Install weather barrier as recommended by Manufacturer and indicated on drawings.
- C. Install self-adhered membrane flashings as indicated on drawings.
- D. Install self-adhered membrane flashings as indicated on drawings and seal leading edges.

3.03 INSTALLATION

- A. Install panels on walls in accordance with manufacturer's written instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.
- D. Locate joints over supports.
- E. Lap panel ends minimum 2 inches.
- F. Provide expansion joints where indicated.
- G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.
- H. Install insert baffles at each panel weeps.

3.04 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

3.05 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.
- D. After completing installation, remove and recycle debris, excess materials and debris from project site per Section 01 74 19.

END OF SECTION

**SECTION 07 46 16
ALUMINUM SIDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum Cladding Battens for exterior walls
- B. Trim, flashings, accessories, and fasteners for aluminum cladding.

1.02 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- B. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates 2022.
- C. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films 2007 (Reapproved 2015).

1.03 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Siding materials, underlayment, flashings, fasteners and accessories.
 - 3. Siding materials, flashings, fasteners and accessories.
 - 4. Dimensions, physical properties, and typical details.
 - 5. Storage and handling requirements and recommendations.
 - 6. Installation instructions and recommendations.
- C. Shop Drawings: Indicate layout, methods of attachment and support clips, provisions for movement, flashing, trim, edge and field conditions, interface with adjacent materials, locations of cutouts or special shapes, existing construction, and details.
- D. Samples: For each finish product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns, including the following:
 - 1. Siding: Two of each type; full panel width by 12 inches long.
 - 2. Fasteners and Accessories: Two of each type; full size, and indicate use.

1.04 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project Record Documents:
 - 2. Operation and maintenance data.
 - 3. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
 - 4. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide a written guarantee, signed and issued in the name of the owner, covering the metal cladding/cladding material for 15 (fifteen) years from the date of Substantial Completion.
- C. Manufacturer's warranty on siding and trim accessories finishes to cover the following:
 - 1. Color fading of not more than five Hunter color-difference units when tested in accordance with ASTM D2244.
 - 2. Degree of chalking of eight or greater when tested in accordance with ASTM D4214.
 - 3. Cracking, checking, peeling, or failure of paint to adhere to metal substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum Siding Manufacturers:
 - 1. Basis of Design: Longboard Architectural Products: Link & Lock Battens;
www.longboardproducts.com.

2.02 ALUMINUM CLADDING AND COMPONENTS

- A. Horizontal Aluminum Cladding:
 - 1. Profile: 1-5/8" X 8 inch (41mm X 203mm) Link & Lock Batten extruded aluminum 6063-T5.
 - a. Finish coating: Powder coated finish
 - b. Color: color as selected from Manufacturers standard line.
 - c. Gloss: 30 ± 5.
 - d. Thickness: 1/16 inch (1.65mm) base metal thickness.
 - e. Profile: 1-5/8" X 8 inch (41mm X 203mm) X 24 ft (7315.2mm) batten.

2.03 MATERIALS

- A. Precoated Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper, with texture and pattern as selected; continuous-coil-coated on exposed surfaces with indicated finish coating, and manufacturer's standard panel back coating.

2.04 ACCESSORIES

- A. Batten End Caps with matching powder-coated finish.
- B. Internal Stiffener.
- C. Attachment Clips: Mounting Clips and End Mounts that are shipped loose for field installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate conditions before beginning installation.
- B. Verify dimensions and acceptable substrate condition.

- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.
- D. Do not proceed with installation until unacceptable conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Prepare surfaces as recommended by manufacturer.
- B. Protect surrounding areas and adjacent surfaces during execution of this work.

3.03 INSTALLATION

- A. Install aluminum siding, trim, and accessories in accordance with manufacturer's written instructions.
- B. Attach siding using manufacturers recommended fasteners, sealants, and adhesives, allowing for thermal expansion.
- C. Provide concealed fasteners except where approved on shop drawings.

3.04 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove grease and oil films, excess joint sealer, handling marks, and other installation debris from aluminum siding, leaving siding clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to material finishes.

END OF SECTION

**SECTION 07 46 43
COMPOSITION SIDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior siding and trim made from a polymeric, fly ash, and glass fiber

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Furring.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Flashing.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- C. Samples: For each finish product specified, provide two complete sets of color samples representing manufacturer's full range of available colors and patterns, including the following:
 - 1. Siding: Two of each type; full panel width by 12 inches long.
 - 2. Fasteners and Accessories: Two of each type; full size, and indicate use.
- D. Test Report: Showing compliance with specified performance requirements.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original packaging and clearly identified.
- B. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

- C. Protect materials from harmful environmental elements, construction dust, and other potentially detrimental conditions.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two year period after Date of Substantial Completion.
- C. Manufacturer's Warranty: Provide manufacturer's standard warranty of twenty years from Date of Substantial Completion .

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Composition Siding:
 - 1. Westlake Royal Building Products; Product: Channel Siding and Trim.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPOSITION SIDING

- A. Composite Siding: Polymeric blend, fly ash, and glass fibers siding.
 - 1. Width: As indicated on drawings.
 - 2. Nominal Thickness: 3/4 inch.
 - 3. Exposed Texture: Smooth.
- B. Product:
 - 1. Westlake Royal Building Products; Poly Ash Siding.
- C. Composition Trim Boards: Exterior synthetic trim.
 - 1. Physical Properties:
 - a. Density, ASTM C 1185: 40 to 50 pcf.
 - b. Water Absorption, ASTM D 570: Less than 1.5 percent.
 - 2. Manufacturing Tolerances:
 - a. Width: Plus or minus 1/16 inch.
 - b. Thickness: Plus or minus 1/16 inch.
 - c. Length: Plus 2 inches, minus 0 inch.
 - d. Edge Cut: Plus or minus 2 degrees.
 - 3. Exposed Texture: As indicate on drawings.
 - 4. Trim Sizes: As indicated on the drawings.
 - 5. Product:
 - a. Westlake Royal Building Products; Poly Ash Trim.

2.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Comply with local building code in accordance with authorities having jurisdiction (AHJ) for wind load resistance requirements of project location.

2.04 ACCESSORIES

- A. Furring: See Section 06 10 00.

- B. Clips and Anchors: Provide as indicated in accordance with siding manufacturer; conceal unless otherwise indicated.
- C. Flashing: See Section 07 62 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Do not begin until unacceptable conditions have been corrected.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
 - 1. Use trim details as indicated on drawings.
 - 2. Touch-up field cut edges before installing.
 - 3. Pre-drill screw holes if necessary to prevent breakage.
- B. Securely attach siding boards to furring, using fastener size, number, spacing, and minimum dimensions from board edges and ends in accordance with manufacturer's recommendations.
 - 1. Cut and route siding boards using carbide-tipped blades to prevent frayed edge cuts.
 - 2. Pre-drill holes located less than 1-1/2 inches from ends of boards, 1 inch from board edges, and in siding boards 3 inches wide or less.
 - 3. Install fasteners perpendicular to siding substrates and flush with surface of board.
- C. Allow space for thermal movement between both ends of siding boards that butt against each other and trim.
- D. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

3.03 CLEANING

- A. Clean siding boards in accordance with manufacturer's maintenance instructions, using cleaning materials and methods acceptable to siding manufacturer.

3.04 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Repair damage to adjacent substrates and surfaces.
- C. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 07 46 46
FIBER-CEMENT SIDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber-cement siding.

1.02 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- C. ASTM C1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards; 2008, reapproved 2016.
- D. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

1.03 SYSTEM DESCRIPTION

- A. Primed, machine finished and site finished siding; site assembled, on furring for installation over sheathed walls with weather barrier.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Printed preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- C. Shop Drawings: Indicate component details and anchorage for specified project criteria:
 - 1. Interface details with adjacent systems or materials.
 - 2. Provide calculations for loadings and stresses of fasteners, stamped by a Professional Engineer or applicable model code authority evaluation report (e.g. ICC-ES).
- D. Samples: 12 inches by width of unit, or 12 by 12 inch for panel products, of each type and texture specified.
- E. Test Report: Applicable model code authority evaluation report for project criteria (e.g. ICC-ES).
- F. Installer's Qualification Statement.
- G. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- H. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

1.05 MOCK-UP

- A. See Section 01 43 39 - Free Standing Building Mockup, for full scale building mock-up and additional requirements.
- B. Construct mock-up, 8 feet long by 4 feet wide; including all panel and siding types and soffit system, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation in mock-up.
- C. Locate where directed by Architect.
- D. Mock-up may not remain as part of the Work.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum three years of experience and approved by manufacturer.

1.07 COORDINATION

- A. Coordinate with other trades affecting or affected by Work of this Section.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store products under waterproof cover and elevated above grade, on a flat surface.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide thirty year manufacturer warranty for manufacturing defects.
 - 1. Warranty to include labor and material replacement or reimburse the Covered Person for up to twice the original retail cost of the defective portion of the Product

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, as calculated in accordance with Building code and as noted on Structural Drawings.
 - 1. Maximum allowable deflection of siding: 1/240.
 - 2. Design Wind Pressure: Refer to structural drawings for design criteria and requirements.
- B. Design fastener system to provide for movement of components without damage, undue stress on fasteners, or other detrimental effects when subject to Design Wind Pressure and thermal movement.
- C. Accommodate positive drainage for moisture entering or condensation occurring within system to exterior.
- D. Products of this Section, and related Sections, shall provide continuity of weather barrier at building enclosure elements.

2.02 MATERIAL

- A. General Requirements:
1. Wet Flexural Strength: ASTM C1185, Avg. 1450 psi.
 2. Length Moisture Movement: ASTM C1185, Linear change (%): 0.05 or 1/4 inch.
 3. Water Tightness: No water droplets were observed on any specimen.
 4. Freeze-Thaw: ASTM C1185, No damage or defects were observed.
 5. Heat-Rain: ASTM C1185, No crazing, cracking, or other deleterious effects, surface or joint changes were observed in any specimen.
 6. Surface Burning: ASTM E84, Flame Spread: 0, Smoke Developed: Less than 5.
 7. Wind Load: Positive: Avg. 147.68 psf, Negative: Avg. 156.98 psf.
 8. ICC Evaluation Service, Inc. (ICC-ES) Report No. NER 405 - James Hardie and NER 690 - Nichiha Fiber Cement.

2.03 FIBER-CEMENT SIDING

- A. Fiber Cement Siding - Lap: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
1. Style: Standard lap style.
 2. Texture: Smooth.
 3. Length: 12 ft, nominal.
 4. Width (Height): 5-1/4 inches.
 5. Thickness: 5/16 inch, nominal.
 6. Finish: Factory applied primer.
 7. Color: As indicated on drawings.
 8. Warranty: 30 year limited; transferable.
 9. Products:
 - a. James Hardie Building Products, Inc: www.jameshardie.com/#sle.
 - b. Nichiha USA, Inc: www.nichiha.com/#sle.
 - c. Woodtone Industries; www.woodtone.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fiber Cement Siding - Panel: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
1. Texture: Smooth.
 2. Length (Height): 96 inches, nominal.
 3. Width: 48 inches.
 4. Orientation: Horizontal.
 5. Thickness: 5/16 inch, nominal.
 6. Finish: Factory applied primer.
 7. Color: As scheduled.
 8. Warranty: 30 year limited; transferable.
 9. Products:
 - a. James Hardie Building Products, Inc: www.jameshardie.com/#sle.

- b. Nichiha USA, Inc: www.nichiha.com/#sle.
 - c. Woodtone Industries; www.woodtone.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Shingle Panels: Panels giving appearance of multiple shingles made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
1. Style: Random width, straight edge.
 2. Texture: Wood grain textured.
 3. Length: 48 inches.
 4. Width (Height): 7 inches.
 5. Thickness: 5/16 inch, nominal.
 6. Finish: Woodtone Industries .
 7. Color: As indicated on drawings.
 8. Warranty: 30 year limited; transferable.
 9. Products:
 - a. James Hardie Building Products, Inc: www.jameshardie.com/#sle.
 - b. Nichiha USA, Inc: www.nichiha.com/#sle.
 - c. Woodtone Industries; www.woodtone.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Soffit Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
1. Texture: Smooth.
 2. Length: 96 inches, nominal.
 3. Width: 48 inches.
 4. Thickness: 5/16 inch, nominal.
 5. Finish: Factory applied primer.
 6. Manufacturer: Same as siding.

2.04 ACCESSORIES

- A. Furring Strips: See Section 06 10 00 - Rough Carpentry
- B. Fiber Cement Trim: Same material and texture as siding.
 1. Size: 5/4 inch x varying widths.
- C. Metal Trim: Extruded aluminum alloy 6063-T5 temper.
 1. See Section 07 62 00 Sheet Metal Flashings and Trim.
 2. Finish: Bonderized.
 3. Color: As selected by Architect.
- D. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inch, minimum or recommended by Manufacturer.
 1. Fasteners as recommended by Manufacturer for wind speed and exposure category based on ICC Evaluation Service, Inc. (ICC-ES) Report.
 2. Fastener application to be approved in Mock-up.

- E. Exterior Soffit Vents: One piece, perforated, ASTM B221 (ASTM B221M), 6063 alloy, T5 temper, aluminum, with flat panel edge and manufactured especially for soffit application, and provide continuous vent.
 - 1. Product:
 - a. Air Vent Inc.; Continuous Soffit Vent SV202.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Weather Barrier: As specified in Section 07 25 05 - Building Wrap Weather Barriers
- G. Self-Adhered Membrane Flashings: See Section 07 25 11.
- H. Joint Sealer: As specified in Section 07 92 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that water-resistive barrier has been installed over substrate completely.

3.02 INSTALLATION

- A. Install sheet metal flashing:
 - 1. Above door and window trim and casings.
 - 2. Above horizontal trim in field of siding.
 - 3. Above horizontal trim exposed to rain edges of panels or siding.
- B. Install in accordance with manufacturer's instructions and recommendations.
 - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 - 3. Use trim details indicated on drawings.
 - 4. Touch up field cut edges before installing.
 - 5. Pre-drill nail holes if necessary to prevent breakage.
- C. Fasten to solid backing in accordance with National Evaluation Service Report for specified design wind pressure, wind speed and exposure.
- D. Joints in Lap Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints 32 inches, minimum between successive courses.
 - 1. Install joint flashing in accordance with manufacturer instructions and seal joints.
- E. Joints in Panels and Reveal Panels: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- F. Exterior Soffit Vents: Install in accordance with manufacturer's written instructions and at locations indicated on drawings; provide vent area as indicated.
- G. Panel Siding:
 - 1. Place fasteners no closer than 3/8 inch from panel edges and no closer than 2 inches from panel corners.
 - 2. Install to maximum variation in alignment of 1/8 inch in 10 linear feet.
- H. Install accessories as detailed on drawings and in accordance with manufacturer's instructions.
- I. Finish Painting: See Section 09 91 13.

3.03 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.
- C. Remove and recycle debris from project site per Section 01 74 19.

END OF SECTION

SECTION 07 54 13
THERMOPLASTIC MEMBRANE ROOFING (TPO)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fully adhered membrane roofing system.
- B. Roof insulation over wood substrate.
- C. Cover board.
- D. Roof Vapor Retarder
- E. Leak Detection.
- F. Walkway pads.

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. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2022a.
- D. ASTM D471 - Standard Test Method for Rubber Property--Effect of Liquids 2016a (Reapproved 2021).
- E. ASTM D5147/D5147M - Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material 2018.
- F. ASTM D751 - Standard Test Methods for Coated Fabrics 2019.
- G. ASTM D573 - Standard Test Method for Rubber — Deterioration in an Air Oven 2004 (Reapproved 2019).
- H. ASTM D816 - Standard Test Methods for Rubber Cements; 2006 (2016).
- I. ASTM D1149 - Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment 2018.
- J. ASTM D2137 - Standard Test Methods for Rubber Property--Brittleness Point of Flexible Polymers and Coated Fabrics; 2011.
- K. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing 2021.
- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- M. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.
- N. FM 4470 - Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction 2016.

- O. FM 4474 - Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures 2010.
- P. NRCA (RM) - The NRCA Roofing Manual 2023.
- Q. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.
- R. UL (FRD) - Fire Resistance Directory Current Edition.
- S. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc. Current Edition, Including All Revisions.
- T. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. See Section 01 30 00 - Administrative Requirements, for pre-installation meeting procedures.
- B. Preinstallation Meeting: Conduct a preinstallation meeting two weeks prior to the start of the work of this section; require attendance by all affected installers.
 - 1. Agenda:
 - a. Review in detail Architect's Specifications, roof plans and roof and flashing details.
 - b. Review Factory Mutual and/or Underwriters Laboratories requirements, and resolve conflicts.
 - c. Review required submittals both completed and yet to be completed.
 - d. Review Drawings for location of differing membrane applications, roof slope, deck type, drainage, membrane attachment, expansion joints, flashing, details, and like.
 - 1) Resolve any conflicts between what is considered good roofing practice and Specifications.
 - e. Review proposed roofing system and recommended work practices for its installation.
 - f. Determine whether different roof areas have different requirements.
 - g. Review required frequency/inspection count, testing, certifying and material usage accounting procedures in accordance with manufacturer's recommendations.
 - h. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
 - 1) Designate which areas on site to be available for use as storage area and working area.
 - i. Review procedures to be followed to provide proper protection of roof system during and after construction of roof.
 - j. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - k. Review notification procedures for weather or non-working days.
 - l. Record discussion of conference including decisions and agreements reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
 - m. Any additional Manufacturer's Agenda items.
- C. Scheduling:

1. Sequence installation of roofing with related units of work specified in other sections to ensure that roof assemblies including roof accessories, flashing, trim and joint sealers are protected against damage from effects of weather, corrosion and adjacent construction activity.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 1. Product data sheets and performance test data for each material required, including:
 - a. Membrane.
 - b. Membrane fasteners.
 - c. Insulation.
 - d. Adhesives.
 - e. Insulation fasteners.
 - f. Metal accessories.
 - g. Calks and sealants.
 - h. Unreinforced flashing material.
 - i. Preformed corners and boots.
 - j. Other required materials.
 2. Manufacturer's standard details for each applicable project condition.
- C. Assembly Data: Provide Stamped engineered calculations licensed in the State the project is located, indicating roof assembly meets higher of either, Building Code or Owner's building insurance required values for wind uplift.
- D. Shop Drawings: Submit roof drawings indicating details to be employed in project. Include:
 1. Outline and size of roof.
 2. Membrane sheet layout.
 3. Location and type of penetrations.
 4. Perimeter and penetration flashing detail references.
 5. Complete drawings of non-manufacturer-standard details to be used, with details of construction.
 6. Indicate elevation changes in parapet walls, fire walls, adjacent roof areas, and similar roof geometry.
 7. Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, mechanical fastener layout, and paver layout.
- E. Test Report:
 1. Pull test results for substrate indicated on drawings; submit additional copy to manufacturer for evaluation.
 2. Wind design testing criteria per FM 4474, UL 580 or UL 1897.
- F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions, special procedures, and perimeter conditions requiring special attention.
- G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 1. Manufacturer's written approval of this specification and of any proposed deviations from specification or drawings or previously approved details.

2. Manufacturer's approval does not constitute a waiver of requirements of this specification or drawings or approval of deviations not specifically itemized.
 3. Do not proceed with such deviation without written approval of Architect.
- H. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
1. Submit report within two business days after site visit.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
1. Completed request for warranty, by manufacturer-authorized installer, including following items.
 - a. Samples and data sheets of materials not supplied or approved by manufacturer.
 - b. Type and thickness of insulation.
 - c. Shop drawings specified above.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with NRCA (RM) and manufacturer's written instructions.
- B. Roofing system warranty provided by Membrane Manufacture.
- C. Manufacturer required to produce and supply membrane and accessories.
- D. Applicator Qualifications: Company specializing in performing work of this section with minimum five years experience.
 1. Use an applicator currently approved in writing by Manufacturer of roofing system.
 2. Use skilled workers trained and experienced in crafts and familiar with requirements and methods needed for proper performance of Work.
- E. Membrane manufacturer technical representative to make site inspections, before, during, and after installation of Work.
 1. Inspections to be performed and documented by designated and properly qualified technical representative of membrane manufacturer.
 2. Verify that materials and Work meet specified requirements.
 3. Should Work and/or materials not meet specified requirements, promptly advise Architect with recommended course of action.

1.06 PROJECT CONDITIONS

- A. Coordinate work with installation of associated counterflashings installed by other sections as work of this section proceeds.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Storage of Materials:
 1. Deliver insulation to job site in its manufacturer's original container, with labels intact and legible.
 2. Maintain packaging, seals and labels intact until time of use.
 3. Store roofing materials, including insulation, in a dry place, on raised platforms, and cover with waterproof tarpaulins, protected from sun and weather.
 4. Store solvents, sealants, and adhesives in a cool, dry area.

5. Keep lids tightly sealed on sealants, solvents and adhesives.
6. Do not overload roof structure by concentrating stored materials in certain locations.
7. Store adhesives at temperature between 60 and 80 degrees F.

1.08 FIELD CONDITIONS

- A. Do not apply roofing membrane or insulation during inclement weather or when ambient temperatures are below 40 degrees F, unless conditions are as recommended by Manufacturers printed instructions.
- B. Do not apply roofing membrane to damp or frozen deck surface; do not begin work until surfaces are sufficiently dry to receive new work.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be rendered watertight during same day.
- D. Refrain from roofing operations when wind velocity is sufficiently high to lift roofing membrane sheets and pose a danger to workers.

1.09 MANUFACTURER'S INSPECTIONS

- A. Roofing System Manufacturer to provide following:
 1. Keep Architect informed as to progress and quality of work as observed.
 2. Report to Architect in writing any failure or refusal of Contractor to correct unacceptable practices called to Contractor's attention.
 3. Confirm after completion of project and based on manufacturer's observation and tests that manufacturer has observed no applications procedures in conflict with specifications other than those that may have been previously reported and corrected.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer:
 1. Total system and no dollar limit to include membrane, insulation and flashing covering Thirty (30) years: Defective materials, installation and watertight integrity of roofing system.
 - a. Warranty Wind Speed: 100 mph.
 - b. No exclusions for ponded water.
 - c. For repair and replacement include costs of both material and labor in warranty.
- C. Installer: 2 years defective materials and installation, including any resulting damage to building materials.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: Firestone Building Products Co: Product: UltraPly TPO Fleece Backed; www.firestonebpco.com.
- B. Carlisle SynTec Incorporated; Product Sure-Weld: www.carlisesyntec.com.
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Installed roofing membrane and base flashings to remain watertight, resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. UL (FRD), Class A for Roofing System.
- C. Wind resistance to meet:
 - 1. Comply with UL 580, UL 1897 or FM 4474, Wind Loads to Roof Systems and Roof Deck Securement.
 - 2. Wind Design Criteria: As indicated on structural drawings.
 - a. Designed to withstand wind uplift forces calculated with ASCE 7.

2.03 MATERIALS

- A. Membrane: Scrim-reinforced, thermoplastic polyolefin (TPO)-based sheet with fleece backing per ASTM D6878/D6878M and bearing UL label on packaging.
 - 1. Sheet Width: 120 inches minimum.
 - 2. Thickness: 0.080, nominal, when measured in accordance with ASTM D751.
 - a. Minimum weather surface thickness: 0.033 inch.
 - b. Provide 0.060 nominal membrane on back of parapet over 8 inches above horizontal surface.
 - 3. Color: White.
 - 4. Breaking Strength: 460 lbf, when tested in accordance with ASTM D751, Grab Method.
 - 5. Elongation of unreinforced membrane ASTM D751: 25% minimum.
 - 6. Tear strength (ASTM D751, Procedure B), 8 x 8 inch sample: 120 lbf
 - 7. Brittleness test (ASTM D2137, at minus 45 deg C): Pass.
 - 8. Puncture Resistance: 450. lbf, minimum, when tested in accordance with FTM 101C - Method 2031.
 - 9. Factory seam strength (ASTM D816, Method B): Sheet failure.
 - 10. Water absorption (ASTM D471) 158 degrees F for 7 days: Plus 3.0 percent maximum weight change
 - 11. Ozone resistance of unreinforced membrane: No cracking when tested in accordance with ASTM D1149, for 70 hr at 100 degrees F.
 - 12. Weather resistance (Xenon arc: 4000 hrs, EMMAQUA: 2,000,000 Langleys): Pass.
 - 13. Heat aging (ASTM D573), 28 days at 212 degrees F: Break at 225 lbf; elongation of 500 percent.
- B. Vapor Retarder: SBS modified bitumen adhesive, factory tri-laminated woven with polyethylene surface. complying with requirements of fire rating classification; compatible with roofing and insulation materials.
 - 1. Fire-retardant adhesive.
 - 2. Thickness: 30 mils per ASTM D5147/D5147M.
 - 3. Tensile Strength: 64 lbf/in method MD per ASTM D5147/D5147M.
 - 4. Ultimate Elongation: 52 percent method MD per ASTM D5147/D5147M.
 - 5. Vapor permeability: Less than 0.017 perm inch, measured in accordance with ASTM E96/E96M.
 - 6. Product:

- a. Firestone Building Products Co: Product: V-Force Vapor Barrier Membrane;
www.firestonebpco.com.
- C. Adhesives:
 1. Insulation and Protection Assembly:
 - a. Manufacturer's standard
- D. Foil Tape:
 1. Product: Sika 25/50 Foil Tape; www.sika.com.
- E. Accessories: Single source products as required by Manufacturer.
- F. Coated Sheet Metal: Flexible non-reinforced thermoplastic polyolefin membrane factory laminated to hot dipped galvanized steel, G-90.
 1. Type: Manufacturer's standard
 2. Gauge: 24
 3. Color: White
- G. Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
 1. High Load Fasteners and plates as recommended by manufacturer.
- H. Flashing: Same membrane as specified above.
 1. Vent stacks, pipes, drains, and corners: Prefabricated pipe boots and inside and outside corners provided by manufacturer.
 2. Field-fabricated flashing for vent stacks, pipes, drains, and corners: 0.055 inch thick, ethylene-propylene-based membrane.
 3. Exception: Perimeter gravel stops and drip edges, use manufacturer provided coated metal.
- I. Resin Flashing: Two (2) layers, one-part pourable sealer liquid flashing with ultraflash fabric as recommended by manufacturer.
- J. Roof Walkways:
 1. Color: White
 2. Product: Ultra TPO Walkpad manufactured by Firestone Building Products Co.
- K. Sealants:
 1. All-Purpose Sealant: Water cut-off mastic, pitch-box sealer, and to seal membrane to metal. Type approved by manufacturer.
 2. Cut-Edge Sealant: Seal exposed cut edges of reinforced membrane. Type approved by manufacturer.
- L. Seam Cleaner: Remove contaminants from surface of membrane where hot-air welding is to occur. Type approved by manufacturer for application.
- M. Cover Board:
 1. Cover Board: Glass mat faced gypsum panels, ASTM C1177/C1177M, 1/2 inch thick, sizes to minimize joints in place; water repellent paper faces; ends square cut.
 2. Manufacturer:
 - a. Basis of Design: DensDeck Prime with Eonic Technology manufactured by G-P Gypsum Corp; www.densdeck.com.

- b. Dexcel manufactured by National Gypsum; www.nationalgypsum.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 3. Fire Resistance:
 - a. Noncombustible when tested in accordance with ASTM E136
 4. Board Size: 48 x 48 inch.
- N. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type II, Class 2, CGF (Coated Glass Facer) both faces and with following characteristics:
 1. Compressive Strength: 20 psi
 2. Board Size: 48 x 48 inch.
 3. Board Thickness: 1-1/2 inch maximum per board with joints staggered. See drawings for overall thickness.
 4. Linear Change: 2% maximum.
 5. Thermal Resistance: LTTR-value of 5.7 per inch, ASTM C1289.
 - a. Total R-value: As indicated on drawings.
 6. Board Edges: Square.
 7. Tapered: As shown on drawings.
 8. Manufacturer: Accepted in writing by membrane manufacturer and approved by its manufacturer for an adhered installation.

2.04 LEAK DETECTION

- A. Provide electronic manual tested leak detection system over horizontal and vertical areas after installation of roofing assembly.
- B. Grounding per Manufacturer's Written Requirements:
 1. Type as recommended by Manufacturer for application.
- C. Manufacturers:
 1. Electronic Field Vector Mapping (EFVM) manufactured by International Leak Detection; www.leak-detection.com.
 2. Electric Conductance Leak Detection manufactured by Detec Systems, www.detecsystems.com
 3. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which work of this Section will be performed.
 1. Correct conditions detrimental to timely and proper completion of Work.
 2. Do not proceed until unsatisfactory conditions are corrected.
- B. Verification of Conditions:
 1. Layout: Verify layout of work before beginning installation.
 2. Existing conditions: Examine substrate before beginning installation.
 - a. Examine surfaces for inadequate anchorage, drainage, foreign material, moisture and unevenness which would prevent execution and quality for application of roofing system as specified.
 3. Verify work of other trades which penetrates roof deck has been completed.

4. Verify that positive roof slope exists in areas.
5. Verify that rooftop mechanical units are to have their condensation lines piped to drains or off roof surface.
6. Block off or shut down positive pressure building ventilation systems during application to prevent sheet from billowing during application.
7. Concrete: Verify that concrete is dry, fully cured, and prepared smooth with dust removed. Where deck joints exceed 1/4 inch width and at building expansion joints, provide fastened membrane expansion joint detail.
8. Notification: Notify Architect of unsatisfactory conditions in writing.

3.02 COORDINATION

- A. Coordinate Work of this Section with Work of other Sections.
 1. Verify placement of drain pan linings, and like; coordinate roof penetrations, equipment bases and other conditions as required.
 2. Reset roof drains or scuppers that are not at proper level to drain finished roof before proceeding.

3.03 PROTECTION OF PROPERTY

- A. Protect finished surfaces of building from damage by installation of roofing system.
 1. Protect completed roofing and flashings from damage by subsequent roofing installation and construction traffic.
- B. Protective Coverings:
 1. Lap protective coverings at least 6 inches, secure against wind, and vent to prevent collection of moisture on covered surfaces.
 2. Keep protective coverings in place for duration of roofing work.
 3. Damaged Work and Materials: Restore work and materials damaged during installation to original condition or replace with new materials.

3.04 FASTENERS - GENERAL

- A. Install fasteners with a depth-sensing screw gun to prevent overdriving or underdriving, unless otherwise approved or required by project conditions.

3.05 INSTALLATION, GENERAL

- A. Perform work in accordance with manufacturer's written instructions applicable requirements.
- B. Surface: Dry, broom and blow clean before beginning work, completely free of ice or frost.
- C. Do not apply roofing membrane during cold or wet weather conditions.
- D. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- E. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- F. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

- G. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.06 INSTALLATION

- A. Install leak detection on horizontal surfaces in accordance with manufacturer recommendations.
- B. Install Work of this Section in accordance with:
 - 1. Construction documents
 - 2. Reviewed shop drawings
 - 3. Procedures, as required or recommended by roofing materials manufacturers, regulations of governmental agencies having jurisdiction, Specifications, and as agreed to in pre-roofing meeting.
- C. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
 - 1. Extend vapor retarder under cant strips and blocking to deck edge.
 - 2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.
- D. Install continuous fire retardant wood nailers at gravel stop or drip edge locations and parapets.
- E. Insulation:
 - 1. Handle and secure insulation boards so as to not damage or rupture facer and surface. Cut out damaged areas and replace with structurally sound insulation, properly secured in place.
 - 2. Install boards with longest dimension perpendicular to direction of membrane seams and with end joints staggered. Butt boards as closely as possible with no gaps over 1/4 inch.
 - 3. Adhere polyisocyanurate insulation with adhesive as accepted by Factory Mutual in its current Approval Guide, and in accordance with approved manufacturer's recommendations.
 - 4. Stagger end joints.
 - 5. Taper insulation where shown in drawings, and around drains to create sumps.
 - 6. Fit insulation around penetrations.
 - 7. Apply no more insulation than can be completely covered with finished roofing on same day.
- F. Roofing Membrane:
 - 1. Do not undertake application of more roof insulation and roofing each day than can be completed within same day.
 - 2. At end of each day's work, protect installed roofing and insulation by closing off edge of roofing system.
 - 3. Remove water cut-off completely and clean prior to resuming roofing application.
 - 4. Fully adhere membrane and hot-air weld seams per manufacturer's instructions.
- G. Base Tie-ins:
 - 1. Secure with fasteners and plate termination into vertical surface.
- H. Provide flashing at intersections formed by vertical surfaces, and wherever curbed roof openings, wall, parapets, or other structure join or penetrate roof.
 - 1. Install in accordance with roofing manufacturer's specifications.

- I. Install roof walk at locations shown in accordance with manufacturer's recommendations.
 1. Provide starting from roof access hatch or door and reaching roof-mounted equipment requiring periodic service or monitoring, including around perimeter of such equipment.

3.07 FABRICATION

- A. Conform to SMACNA (ASMM) CDACDA that apply to design, details, dimensions, geometry, metal thickness, and other characteristics of items indicated or as recommended by roofing manufacturer for warranty.
- B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- C. Apply butyl sealant compound between metal flashings and membrane flashings as recommended by manufacturer.
- D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

3.08 FIELD QUALITY CONTROL

- A. Owner will provide testing services in accordance with Section 01 40 00 - Quality Requirements. Contractor shall provide temporary construction and materials for testing.
- B. Manufacturer Quality Control:
 1. Technical representative of manufacturer to periodically (minimum 3 visits) observe Work in progress.
 2. Representative, as a minimum, to be present to observe deck preparation, general installation procedures and final completion.
 3. Notify Architect and Owner's Representative at least twenty-four (24) hours prior to any roofing Work.
 4. Work not to proceed until such observations have been made in field report and conditions have been approved in writing by Architect.
 5. Upon completion of installation to ascertain that entire systems has been installed according to manufacturer's specifications and approved details.
- C. Leak Detection:
 1. Coordinate leak detection testing with installation and curing of fluid-applied membrane waterproofing.
 2. If leaking is found, repair leaking areas with new materials as directed by Architect; repeat test. Repair damage to building.

3.09 CLEANING

- A. Clean adjacent materials and surfaces of any soilage by Work of this Section, and repair as necessary.
- B. Upon completion of work of this Section, promptly remove from job-site debris, empty containers, and surplus materials derived from this portion of Work, and dispose of in a legal manner.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.
- C. Precast concrete splash pads.

1.02 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- C. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.
- 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 A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- F. ASTM B32 - Standard Specification for Solder Metal 2020.
- G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- J. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details per project specific conditions.
- C. Samples: Submit two samples, 12 by 12 inch in size illustrating material of typical standing seam.
- D. Samples: Submit two samples, 12 by 12 inches in size, illustrating metal finish color.
- E. Test Data: Provide test data for roof edge, coping attachment and gutters meeting: ANSI/SPRI/FM 4435/ES-1_requirements.

1.04 MOCK-UP

- A. See Section 01 43 39 - Free Standing Building Mockup, for full scale building mock-up and additional requirements.
- B. Provide a mock-up for evaluation of installation techniques and finished appearance.
 - 1. Finish areas designated by Architect.
 - 2. Include typical fasteners, joint closures, specified finish and edge treatment.
 - 3. Do not proceed with remaining work until workmanship and overall appearance are approved by Architect.
 - 4. Refinish mock-up area as required to produce acceptable work.
- C. Mock-up may remain as part of the Work.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.
- C. Coping Wind Resistance: Meet requirements of ANSI/SPRI/FM 4435/ES-1, Test method: RE-3.
- D. Close gaps in water shedding surfaces.
- E. Paint or finish exposed to view flashing surfaces.

1.06 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.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion. Defective work includes degradation of metal finish and failure of watertightness or seals.
 - 1. Repair and/or replace without additional cost to Owner any water leaks and resulting damage to building materials as may occur under normal usage within warranty period.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, 0.0239 inch thick base metal, 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: As selected by Architect from manufacturer's standard colors.

- B. Pre-Finished Aluminum: ASTM B209/B209M; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with silicone modified polyester coating.
 - 1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.
- C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 PERFORMANCE REQUIREMENTS

- A. Parapet Fascias, Roof Edge Flashing and Copings: Minimum gauge metals, fastener size and spacing to resist wind uplift as noted on Structural Drawings per ANSI/SPRI/FM 4435/ES-1.

2.03 FABRICATION

- A. Field verify dimensions prior to fabrication.
- B. Form sections true to shape, accurate in size, square, and free from distortion or defects.
 - 1. Angle bottom edges of vertical surfaces to form drip.
- C. Fabricate cleats of same material as sheet, interlocking with sheet.
 - 1. Gauge: One gauge heavier than sheet metal component being anchored.
 - 2. Continuous cleat at outside face of coping.
 - 3. Spaced cleats: Two (2) feet on center at inside of coping, minimum 4 inches wide.
- D. Form pieces in longest possible lengths.
- E. Copings: Standing seams at 10 feet on center.
- F. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- G. Form material with standing seams, except where otherwise indicated. At moving joints, use standing seam.
 - 1. Counter flashing: Double S Lock.
- H. Seams:
 - 1. Standing seams: 1 inch high, with sealant at folded corners.
 - 2. Solder-Lap Seams: 1 inch finish width; sweat full with solder.
 - 3. Double S Lock Seams: Form 1-1/4 inch wide S shaped seam on each edge of flashing sheet for concealed fastening.
 - 4. Splice Plates: 12 inch long backing plate with 2 sealants beads each side of joint. No lapped joints permitted.
- I. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
- J. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.
- K. Sheet Metal Pipe Boot:
 - 1. Pipe and Penetration Flashing: Two piece interlocking of galvanized steel, compatible with pipe, membrane flashing and roof systems, and capable of accomodating pipes sized between 3/8 inch and 12 inch.
 - a. Caps: EPDM.
 - b. Metal Thickness: 22 gauge.
 - c. Profile: As indicated on drawings.

- L. Gauges: As scheduled herein.
- M. Cant Dam:
 - 1. Form as detailed.
 - 2. Butt Joints: over lap 6 inches and apply bead of sealant.
- N. Head, Jamb and Sill Flashings:
 - 1. Form as detailed.
 - 2. Provide fully folded or formed end dams and back leg dams on horizontal flashings.
 - 3. Butt Joints: over lap 12 inches and apply 2 beads of sealant at each joint (4 total).

2.04 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Downspouts: Round profile.
- C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Spikes and ferrules.
 - 3. Downspout Supports: Brackets.
- E. Splash Pads: Precast concrete type, 12 x 24 x 2-1/2 inches; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- F. Washers: Neoprene cadmium plated.
- G. Downspout Boots: Steel.
- H. Seal metal joints.

2.05 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Rivets: Stainless steel, 1/8 inch diameter minimum
- C. Screws: Self-tapping, stainless steel, pan head No. 7 x 1 inch minimum.
- D. Self-Adhered Membrane Flashings: See Section 07 25 11 for high temperature membrane flashing under metal flashing.
- E. Primer: Zinc chromate type.
- F. Concealed Sealants: Non-curing butyl sealant.
- G. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- H. Sealant: Gutter seal by Alcoa.
- I. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.
- J. Reglets: Surface-mounted type, galvanized steel; face and ends covered with plastic tape.
- K. Solder: ASTM B32; Sn50 (50/50) type.
- L. Insect Baffle:

1. 20 pours per inch filter foam, adhesive one side, continuous.
2. Compressible Open Cell Baffle.
3. Color: Black.
4. Manufacturer:
 - a. Lamatek: www.lametek.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

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, GENERAL

- A. Install work of this Section in accordance with:
 1. Construction Documents.
 2. Reviewed Shop Drawings
 3. Anchor components firmly into position plumb, level and true.
- B. Install Work watertight and weathertight, without oil canning, buckles, tool marks, fastening stresses, distortion, or defects which impair strength or mar appearance.
- C. Install planes and lines in true alignment.
- D. Allow for sheet metal expansion and contraction.
 1. Provide expansion 40 feet o.c. maximum unless otherwise noted.
 2. Provide with slotted holes at overlapping joints at expansion and contraction joints.
- E. Close flashing planes to cladding completely at ends of flashing.

3.04 INSTALLATION

- A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Install insert baffle cut to size, 1 inch by twice gap width.
- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

- F. Sealant Installation:
 - 1. Apply 1/4 inch diameter bead, centered in full length of Joints.
- G. Soldering:
 - 1. Clean and flux metals prior to soldering.
 - 2. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.
 - 3. Perform soldering with a heavy soldering copper of blunt design, properly tinned for use.
 - a. Perform soldering slowly, with a well heated surface and fill with solder.
 - 4. Do not solder coil-coated galvanized sheet steel.
- H. Secure gutters and downspouts in place with concealed fasteners.
- I. Connect downspouts to downspout boots, and seal connection watertight.
- J. Cover fastener heads with cleat tabs folded back over fastener head.
- K. Set splash pads under downspouts.

3.05 CLEAT INSTALLATION

- A. Secure continuous cleats to substrate with fasteners spaced at 12 inch centers, maximum and in compliance with ANSI/SPRI/FM 4435/ES-1.
- B. Cover fastener heads with cleat tabs folded back over fastener head.

3.06 CORROSION PROTECTION

- A. Protect galvanized steel against corrosion with asphaltic coating compound; 7-1/2 mil dry film thickness applied to each contacting face.

3.07 COUNTER FLASHING

- A. Overlap base flashing 4 inches minimum.
- B. Install bottom edge spring-tight against base flashing.
- C. Miter, and seal corner joints.

3.08 COPINGS

- A. Fabricate with seams spaced approximately 10 feet apart, maximum and in compliance with ANSI/SPRI/FM 4435/ES-1.
- B. Miter and join corners.
- C. Lock exterior edges over continuous cleats secured to substrate.
- D. Slope coping top toward roof.

3.09 ASPHALT PLASTIC CEMENT INSTALLATION

- A. Trowel apply 1/8 inch thick. See roofing Section for materials.

3.10 ROOF PENETRATION FLASHING

- A. General: Form of 4.0 lb/sq. ft. lead, hard tempered.

- B. Flashing: Seal top of flashing to pipes penetrating roof as detailed or recommended by roofing manufacturer.
- C. Storm Collar:
 - 1. Overlap base lead at least 1 inch with 24 gauge prefinished metal storm collar sloped away from penetration.
 - 2. Secure to penetration with clamp and seal as detailed.

3.11 FLASHING PANEL INSTALLATION

- A. Complete all soldering, welding and other heat producing work prior to installation of flashing panels.
- B. Install panels in accordance with manufacturers printed instructions.
- C. Integrate with building weather and air barrier system to maintain integrity of the system
- D. Protect flashing panels from damage during construction

3.12 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.13 CLEANING

- A. As Work progresses, neutralize excess flux with 5 percent to 10 percent washing soda solution, and thoroughly rinse.
- B. Clean exposed surfaces affected by Work of this Section.
- C. Remove from site refuse created by this work, and dispose of in a legal manner.

3.14 SCHEDULE

- A. Through-Wall Flashing extending below grade: Stainless Steel, 22 gauge (0.0299 inch thick).
- B. Cleats and Cant Dam: One gauge heavier than sheet metal component being anchored.
- C. Sill and Ledge Flashings: Stainless Steel; 22 gauge (0.0299 inch thick).
- D. Coping: Meet requirements of ANSI/SPRI/FM 4435/ES-1, Test method: RE-3 or minimum 22 gauge.
- E. Cap, and Parapet: Pre-finished galvanized steel; 22 gauge (0.0299 inch thick).
- F. Sheet Metal Roof Expansion Joint Covers, and Roof-to-Wall Joint Covers: Pre-finished galvanized steel; 22 gauge (0.0299 inch thick).
- G. Roof Drains: Lead, 4.0 lb/sq. ft., hard tempered.
- H. Eave Flashing: Pre-finished galvanized steel; 24 gauge (0.0239 inch thick).
- I. Fascia and Cornices: 20 gauge (0.0359 inch thick).
- J. Gutters and Downspouts: 22 gauge (0.0299 inch thick)
- K. Sheet Metal Parapet Siding: Pre-finished galvanized steel; 22 gauge (0.0299 inch thick) with S-lock joints, 24 inch vertical seams with X-Break shape. Provide at non-occupied roofs.

- L. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports: Pre-finished galvanized steel; 22 gauge (0.0299 inch thick).
- M. Flashing Panels at plumbing penetrations:
- N. Flashing Panels at electrical penetrations:

END OF SECTION

**SECTION 07 72 00
ROOF ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof hatches, manual and automatic operation, including smoke vents.
- B. Safety Railing System.

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

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
 - 1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
 - 2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- D. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

1. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.
- C. Provide five year manufacturer standard warranty for material and workshop to be free of defects.

PART 2 PRODUCTS

2.01 ROOF HATCHES AND VENTS, MANUAL AND AUTOMATIC OPERATION

- A. Roof Hatch Manufacturers:
 1. Basis of Design: Bilco Co.: www.bilco.com
 2. Dur-Red Products: www.dur-red.com/#sle.
 3. Milcor, Inc: www.milcorinc.com/#sle.
 4. JL Industries: www.jlindustries.com.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Roof Hatches: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
 1. Style: Provide flat metal covers unless otherwise indicated.
 2. Mounting Substrate: Provide frames and curbs suitable for mounting on flat roof deck sheathing with insulation.
 3. Thermally Broken Hatches: Provide insulation within frame and cover.
 4. For Ladder Access: Single leaf; 30 by 36 inches.
- C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
 1. Material: Mill finished aluminum, 11 gauge, 0.0907 inch thick.
 2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
 3. Curb Height: 12 inches from surface of roof deck, minimum.
- D. Metal Covers: Flush, insulated, hollow metal construction.
 1. Capable of supporting 40 psf live load.
 2. Material: Mill finished aluminum; outer cover 11 gauge, 0.0907 inch thick, liner 0.04 inch thick.
 3. Factory finish: Bonderite Pretreated Hammertone power coat by JL Industries.
 4. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
 5. Gasket: Neoprene, continuous around cover perimeter.
- E. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
 1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
 2. Hinges: Heavy duty pintle type.
 3. Hold open arm with vinyl-coated handle for manual release.
 4. Latch: Upon closing, engage latch automatically and reset manual release.
 5. Manual Release: Pull handle on interior.
 6. Locking: Padlock hasp on interior.

2.02 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

- A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
 - 1. Design Loadings and Configurations: As required by applicable codes.
 - 2. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - 3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 - 4. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
- B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
 - 1. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
 - 2. See relevant piping system specification section for additional requirements.
- C. Ladder Safety Post:
 - 1. Provide ladder safety post Model LU-2 by Bilco.
 - a. Ladder safety post to be pre-assembled from manufacturer.
 - 2. Performance characteristics:
 - a. Tubular post shall lock automatically when fully extended.
 - b. Safety post shall have controlled upward and downward movement.
 - c. Release lever shall disengage the post to allow it to be returned to its lowered position.
 - d. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" on center and clamp brackets to accommodate ladder rungs up to 1-3/4" in diameter.
 - 3. Post: Shall be manufactured of high strength square tubing.
 - a. Pull up loop shall be provided at the upper end of the post to facilitate raising the post.
 - 4. Material of construction: Hot dip galvanized steel.
 - 5. Balancing spring: Stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.
 - 6. Mounting Hardware: Type 316 stainless steel.
 - 7. Factory Finish: Hot dip galvanized steel, Model LU-2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.

- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

- A. Clean installed work to like-new condition.

END OF SECTION

**SECTION 07 81 23
INTUMESCENT FIRE PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Thin-film intumescent fire protection.
- B. Compressible-rod intumescent fire protection.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Performance characteristics and test results.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Selection Samples: For decorative top coat, color chips representing manufacturer's full range of available colors and sheens.
- D. Verification Samples: For each thickness, color, sheen, and finish required, submit samples not less than 4 inches square on designated substrate illustrating finished appearance.
- E. Test Reports: Published fire resistive designs for structural elements of the types required for the project, indicating hourly ratings of each assembly.
- F. Manufacturer's qualification statement.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of ten years of documented experience.

1.05 REGULATORY REQUIREMENTS

- A. Conform to Building code for fire resistance ratings.
- B. Provide certificate of compliance for fireproofing materials to authority having jurisdiction, indicating approval for use on this project.
 - 1. Prohibited Materials:
 - a. Pentabrominated Diphenyl Ether, CAS # 32534-81-9.
 - b. Octabrominated Diphenyl Ether, CAS # 32536-52-0.
 - c. Decabrominated Diphenyl Ether, CAS # 1163-19-5.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver materials in manufacturer's original, unopened containers with identification labels and testing agency markings intact and legible.
- C. Store products in manufacturer's unopened packaging until ready for installation.
 - 1. Store at temperatures not less than 50 degrees F in dry, protected area.
 - 2. Protect from freezing, and do not store in direct sunlight.
 - 3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.
- D. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Protect areas of application from windblown dust and rain.
- B. Maintain ambient field conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.
 - 1. Provide temporary enclosures as required to control ambient conditions.
 - 2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F without specific approval from manufacturer.
 - 3. Maintain relative humidity between 40 and 60 percent in areas of application.
 - 4. Maintain ventilation in enclosed spaces during application and for not less than 72 hours afterward.
- C. Sequence Work in conjunction with placement of ceiling hanger tabs, mechanical component hangers and electrical components.
- D. Coordinate application of primers performed under Work of Section 05 12 00 with primers specified in this Section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Intumescent Thin-Film Fire Protection for Metal:
 - 1. Contego International, Inc; Contego High Solids Reactive Fire Barrier (HS RFB)
Intumescent: www.contegointernational.com/#sle.
 - 2. Hilti, Inc; Fire Finish Steel Protection Spray CFP-SP WB: www.us.hilti.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Intumescent Compressible-Rod Fire Protection:

2.02 SYSTEM REQUIREMENTS

- A. Fireproofing: Provide intumescent thin-film, compressible-rod, and ____ fire protection systems tested by an independent testing agency in accordance with ASTM E119 and acceptable to

authorities having jurisdiction (AHJ).

1. Provide assemblies listed by UL or FM and bearing listing agency label or mark.
- B. Structural Steel Members: Fire resistance rating of 2 hours.
- C. Structural Steel Beams: Fire resistance rating of 1 hour.
- D. Exposed Steel Deck: Fire resistance rating of 1 hour.

2.03 MATERIALS

- A. Fire Resistive Coating System: Thin film intumescent fire protection system for structural steel.
 1. Thickness: Dry mil thickness in accordance with acceptable test data for substrate.
 2. Surface Burning Characteristics: Tested in accordance with ASTM E84.
 - a. Flame Spread Index (FSI): 25, maximum.
 - b. Smoke Developed Index (SDI): 50, maximum.
 3. Hardness: 80, minimum, when tested in accordance with ASTM D2240, Type D durometer.
 4. Density: 11.4 lb/gallon, minimum.
- B. Fire Resistive Compressible-Rod System: Compressible intumescent fire protection system for structural steel, gypsum board, wood, oriented strand board (OSB), concrete, and concrete masonry units (CMU).
- C. Sealers and Primer: As required by tested and listed assemblies, and recommended by fireproofing manufacturer to suit specific substrate conditions.
- D. Reinforcement: Glass fiber fabric matching type used in tested and listed assemblies.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fire protection; verify that substrates are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 APPLICATION

- A. Comply with manufacturer's instructions for each particular intumescent fire protection system installation application as indicated.
- B. Apply manufacturer's recommended primer to required coating thickness.
- C. Apply fireproofing to full thickness over entire area of each substrate to be protected.
- D. Apply coats at manufacturer's recommended rate to achieve dry film thickness (DFT) as required for fire resistance ratings designated for each condition.
- E. Apply intumescent fire protection by spraying to maximum extent possible, and as necessary complete coverage by roller application or other method acceptable to manufacturer.

3.03 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Immediately after installation of fireproofing in each area, remove overspray and fallout from other surfaces and clean soiled areas.

3.04 PROTECTION

- A. Protect installed intumescent fire protection from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 07 84 00
FIRESTOPPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping of penetrations and interruptions to fire rated assemblies, whether indicated on drawings or not, and other openings indicated.
 - 1. Openings in fire rated walls, floors, and roofs, both empty and those containing penetrations such as cables, conduits, cable trays, pipes, ducts, and similar penetrating items.
 - 2. Gaps between fire rated floor slabs and exterior curtain walls.
 - 3. Gaps located within expansion joints.
 - 4. Openings at each floor level in fire rated shafts or stairwells.
 - 5. Gaps between tops of fire rated walls and underside of fire rated floor or roof assemblies.
- B. Smokestopping of penetrations through non-fire-rated smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- 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. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- H. ITS (DIR) - Directory of Listed Products Current Edition.
- I. FM (AG) - FM Approval Guide Current Edition.
- J. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).
- K. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
- L. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- M. UL (DIR) - Online Certifications Directory Current Edition.

- N. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. See Section 01 30 00 - Administrative Requirements, for pre-installation meeting procedures.
- B. Convene one week before starting work of this section.
- C. Agenda:
 - 1. Review firestopping submittal.
 - 2. Review job site conditions.
 - 3. Outline schedule for installation.
 - 4. Outline reviewing process by building official.

1.04 DEFINITIONS

- A. Construction Gap: An open joint between adjacent rated assemblies; may be a moving joint or static opening, without penetrating items.
- B. Firestop System: Specific firestop material or materials, which when installed in openings in a specific rated assembly, achieve performance required.
- C. Firestopping: Result of installation of firestop system.
- D. Listing: Current, published listing of a system in a qualified listing agency's directory.
- E. Listing Agency: Independent testing agency that has conducted tests and classified firestop systems for particular applications, which conducts routine in-plant follow-up inspections, and which lists tested systems in a published directory.
- F. Penetrating Item: Any item (pipe, duct, conduit, cable, etc.) that passes completely through a rated assembly through an opening of any size.
- G. Rated Assembly: Wall, floor, roof/ceiling, or other construction which is required to have an hourly fire rating or a smoke resistance rating.
- H. Through Penetration: Hole through a rated assembly made to accommodate passage of a penetrating item or an empty hole made for another purpose and not repairable using the original materials of construction.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
 - 1. Submittals for this scope of work are received by the Architect for information and record only. Architect will return not reviewed and log into records.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
 - 1. Provide firestopping matrix as required by authority having jurisdiction.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations
- D. Submit schedule of fireproofing and product data to authority having jurisdiction for approval.
- E. Shop Drawings: Show typical installation details including reinforcement, anchorage, fastenings and method of installation for each type of firestopping condition.
- F. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

- G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- H. Certificate from authority having jurisdiction indicating approval of materials used.
- I. Manufacturer's qualification statement.
- J. Installer's qualification statement.

1.06 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Current evaluation reports published by ICBO will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Trained and approved by manufacturer to install specified fireproofing assemblies.
 - 2. Verification of minimum three years documented experience installing work of this type.
 - 3. Licensed by local authorities having jurisdiction (AHJ).

1.07 REGULATORY REQUIREMENTS

- A. Conform to Building code for fire resistance ratings.
- B. Provide certificate of compliance for firestopping materials to authority having jurisdiction, indicating approval for use on this project.
 - 1. Prohibited Materials:
 - a. Pentabrominated Diphenyl Ether, CAS # 32534-81-9.
 - b. Octabrominated Diphenyl Ether, CAS # 32536-52-0.
 - c. Decabrominated Diphenyl Ether, CAS # 1163-19-5.

1.08 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Install one firestopping assembly representative of each fire rating design required on project.
 - 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
- C. Obtain approval of authorities having jurisdiction (AHJ) before proceeding.
- D. If accepted, mock-up will represent minimum standard for this work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed and labeled containers. Handle and store materials in accordance with manufacturer's instructions.

- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.10 PROJECT CONDITIONS

- A. Coordinate construction and cutting of openings so that each particular firestop system may be installed in accordance with its listing, including sizing, sleeves, and penetrating items.

1.11 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. Basis of Design: Specified Technologies Inc: www.stifirestop.com/#sle.
 - 2. 3M Fire Protection Products: www.3m.com/firestop.
 - 3. Hilti, Inc: www.us.hilti.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Furnish products identical to those tested for classification by listing agency.
- B. Firestopping Materials: Any materials meeting requirements including, but not limited to fire safing and smoke seals code approved for application.
- C. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- D. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- E. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- F. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 SINGLE SOURCE

- A. All instances of a specific firestop system shall be made using products of the same manufacturer; where multiple installers (e.g. different subcontractors) are responsible for installation of firestopping, all installers shall use the same system made by the same manufacturer.
 - 1. Firestopping used within building shall be from one manufacturer.
 - 2. Contractor shall coordinate systems with subcontractors.

2.04 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Provide complete systems of asbestos-free firestopping capable of maintaining an effective barrier against flame, smoke and gases, listed by UL, WH, ULC, or FM, or other independent testing agency, and acceptable to authorities having jurisdiction.
 - 1. Fire Resistance Ratings: In accordance with applicable building code.
 - 2. Materials: Provide materials of type, thickness, width and density to provide and maintain fire resistance rating.
 - 3. Through Penetrations: Provide systems meeting UL 1479 or ASTM E814, completely filling annular spaces to prevent passage of flame, smoke and gases through opening in the separation in which it is installed.
 - 4. Building Joints: Provide systems meeting UL 2079 or ASTM E1966.
 - 5. Compatibility: Provide materials which are compatible with materials used in systems including materials such as CPVC piping used in or on penetrants as well as construction materials used in conjunction or contiguous with firestopping system.
- B. Firestopping materials shall be capable of maintaining an effective barrier against flame, smoke and gases, and suitable for firestopping of penetrations made by steel, glass, plastic, and insulated pipe.
- C. Fire rating classification shall not require removal of insulation on insulated pipe.
- D. Firestop rating shall not be less than rating of penetrated assembly.
- E. Firestop systems do not re-establish structural integrity of load bearing partitions/assemblies, or support live loads and traffic.
- F. Installer shall consult Architect prior to penetrating any load bearing assembly.
- G. For firestop applications that exist for which no UL tested system is available through any manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation.
- H. Compatibility: Provide products that are compatible with each other, with substrates forming openings, and with items, if any, penetrating firestopping, under conditions represented by this project, based on testing and field performance demonstrated by manufacturer.
- I. Firestopping not to be water soluble where subject to moisture.
- J. High traffic openings (i.e. cable tray openings) firestop with system allowing for repeated removal and reuse of firestop material such as pillows or putty.
- K. Firestopping Exposed To View: Provide products with flame spread index of less than 25 and smoke developed index of less than 450, when tested in accordance with ASTM E84.
- L. Firestopping Exposed to View, Traffic, Moisture, or Physical Damage: Provide products that after curing do not deteriorate when exposed to those conditions during and after construction.
- M. 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. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
- N. 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.
- O. 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. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- P. 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. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- Q. Heat Activated Firestopping Systems (Intumescent):
 1. In portions of the building requiring blower door testing or other measurements of air transfer between any adjacent spaces, the use of Heat Activated Firestopping Systems is prohibited.

2.05 FIRESTOPPING SYSTEMS

- A. Firestopping:
 1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 or ASTM E 119 that has F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and that meets other specified requirements.
 2. Fire Ratings: See Drawings for require ratings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive work of this section.
 1. Examine substrates, openings, voids, adjoining construction and project conditions.
 2. Confirm compatibility of surfaces scheduled to receive firestopping.
- B. Verify that work within opening has been completed before installing firestopping.
 1. Correct conditions detrimental to timely and proper completion of work.
 2. Coordinate with work of other trades so that firestopping applications can be inspected prior to being covered by subsequent construction.
 3. Start of work will indicate acceptance of substrate.

- C. Verify that penetrating elements are securely fixed and properly located with proper space allowance between penetrations and surfaces of openings.
- D. Do not proceed until substrate and project conditions are satisfactory.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Prime substrates in accordance with manufacturer's written instructions or recommendations.
 - 1. Confine primers to areas of bond; do not allow spillage or migration onto exposed surfaces.
- D. Provide anchoring devices, back-up materials, clips, sleeves, supports and other related materials used in actual fire tests.
- E. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install Work of this Section in accordance with:
 - 1. Construction Documents
 - 2. Reviewed Shop Drawings
 - 3. Requirements of governmental agencies having jurisdiction.
 - 4. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
 - a. Obtain manufacturer's instructions for conditions not fully covered by printed instructions. Record in writing oral instructions received.
 - b. Obtain approval and meet requirements of governmental agencies having jurisdiction.
- B. Clean surfaces in contact with firestop materials of dirt, grease, oil, or other substance that may affect proper installation or fire resistance.
- C. Consult with mechanical engineer prior to installation of any firestops around duct work that might hamper performance of fire dampers.
- D. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- E. Install firestopping with sufficient pressure to properly fill and seal openings for effective smoke seal.
- F. Remove excess firestopping material promptly.
- G. Fill, Void, and Cavity Materials: Use materials recommended by firestopping manufacturer to seal gaps created by non-combustible type damming boards and to seal around cables, conduits, pipes, and where void filler material becomes part of fire rated assembly.
 - 1. Floors and partitions sealed with masonry or concrete:
 - a. Carefully fill and inspect for cracks or other imperfections.
 - 2. Floors:

- a. Filling voids in floors having openings of 4 inches or more in length or width, exclusive of penetrating items, provide firestopping materials which support same load as floor is designed to support, unless area is protected by a permanent barrier preventing loading or traffic on firestopped area.
- b. Protect firestopping materials from damage on surfaces subject to traffic.
3. Pipe Insulation:
 - a. Insulate pipes penetrating fire rated floors and walls with material which provides same performance as firestopping material.
 - b. Extend this material at least 6 inches beyond both faces of opening. Maintain permeating insulation's vapor barrier.
4. Rated Walls: Constructed with horizontally continuous air space, double wythe masonry, or double stud frame construction.
 - a. Provide vertical, 12 inch wide fiber dams for full thickness and height of air cavity at 15 foot intervals maximum.
- H. Sealant: Use non-sagging type where void cannot be dammed sufficiently to contain sealant until cured.
 1. Install damming material or mineral wool as recommended by manufacturer.
 2. Apply sealant to minimize air voids and to ensure sealant is in full contact with penetrating items and surrounding surfaces.
 3. Tool non-pourable sealant to ensure substrate contact if required.
 4. Remove excess sealant in accordance with manufacturer's recommendations. Do not exceed minimum system or design thickness by more than 25 percent.
- I. Mortar:
 1. Install damming material as recommended by manufacturer for application.
 2. Mix mortar in strict accordance with manufacturer's instructions.
 3. Fill openings to minimum thickness as recommended by manufacturer and by tested system or selected design to achieve fire resistance rating.
- J. Firestopping Mineral Wool:
 1. Install by compressing material to minimum compression required tested system or selected design.
 2. Apply firestopping in sufficient thickness, depth and density so as to achieve fire resistance rating.
- K. Firestopping Devices, Collars, and Pillows:
 1. Install in accordance with manufacturer's instructions, to achieve fire resistance rating.
- L. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- M. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Inspect completed installations prior to concealing or enclosing an area containing firestopping materials.
 1. Area to remain accessible until inspection by governing authority
- B. Notify Owner and authorities having jurisdiction prior to concealing or enclosing an area containing firestopping materials.

- C. Owner to employ an independent inspection and testing agency.
- D. Repair defective and damaged work as required to ensure compliance with Contract Documents.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Repair damaged material.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

**SECTION 07 92 00
JOINT SEALANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C1184 - Standard Specification for Structural Silicone Sealants 2018, with Editorial Revision.
- B. ASTM C1135 - Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants 2019.
- C. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- D. ASTM C834 - Standard Specification for Latex Sealants 2017.
- E. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints 2019 (Reapproved 2020).
- I. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).

1.03 ADMINISTRATIVE REQUIREMENTS

- A. See Section 01 30 00 - Administrative Requirements, for pre-installation meeting procedures.
- B. Convene two weeks before starting work of this section.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.

- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Installation Plan: Submit at least four weeks prior to start of installation.
- E. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- F. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- G. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- H. Installation Log: Submit filled out log for each length or instance of sealant installed.
- I. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- C. Installation Plan: Include schedule of sealed joints, including the following.
 - 1. Installation Log Form: Include the following data fields, with known information filled out.
 - a. Date of installation.
 - b. Name of installer.
 - c. Actual joint width; provide space to indicate maximum and minimum width.
 - d. Actual joint depth to face of backing material at centerline of joint.
 - e. Air temperature.
- D. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
 - 1. Identification of testing agency.
 - 2. Name(s) of sealant manufacturers' field representatives who will be observing
 - 3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
 - a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
 - b. Test date.
 - c. Sealant used.
 - d. Stated movement capability of sealant.
 - e. Copy of test method documents.
 - f. Age of sealant upon date of testing.
 - g. Test results, modeled after the sample form in the test method document.
 - h. Indicate use of photographic record of test.

- E. Field Quality Control Plan:
 - 1. Visual inspection of entire length of sealant joints.
 - 2. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
 - a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
 - b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.
 - 3. Field testing agency's qualifications.
 - 4. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- F. Field Adhesion Test Procedures:
 - 1. Allow sealants to fully cure as recommended by manufacturer before testing.
 - 2. Have a copy of the test method document available during tests.
 - 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 - 4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
 - 5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
 - 6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
- G. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
 - 1. Sample: At least 18 inches long.
 - 2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
 - 3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
 - 4. Record results on Field Quality Control Log.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

- A. Scope:
1. Exterior Joints: Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - c. Other joints indicated below.
 3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS

- A. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Applications: Use for:
 - a. Porous substrates.
 2. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
 3. Color: To be selected by Architect from manufacturer's custom range.
 4. Manufacturers:
 - a. Dow Sill; 790 Silicone Building Sealant: www.dow.com.
 - b. Tremco Global Sealants; Spectrem 1: www.tremcosealants.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Applications: Use for:
 - a. Non-porous substrates.
 - 2. Movement Capability: Plus and minus 50 percent, minimum.
 - 3. Color: To be selected by Architect from manufacturer's custom range.
 - 4. Manufacturers:
 - a. Dow Sill; 795 Silicone Building Sealant: www.dow.com.
 - b. Tremco Global Sealants; Spectrem 2: www.tremcosealants.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
 - 2. Color: Standard colors matching finished surfaces.
 - 3. Manufacturers:
 - a. Dow Corporation; 786: www.dow.com.
 - b. Tremco Global Sealants; Proglaze: www.tremcosealants.com.
 - c. Pecora Corporation: www.pecora.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Type ___ - Silyl-Terminated Polyether (STPE) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Hardness Range: 17, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's standard range.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.
 - 5. Extension, ASTM C 1382: 100%
 - 6. 100% Modulus, ASTM C 412: 35 psi.
 - 7. Tensile Strength, ASTM D412: 140-180 psi.
 - 8. Tear Strength, ASTM D1004: 40 pli.
 - 9. Ultimate Elongation at Break, ASTM D412: 800-1000 percent.
 - 10. Rheological, ASTM C639, sag in vertical displacement, 120 degrees F (49 degrees C): No sag.
 - 11. Extrudability, ASTM C 1183: 2-3 sec
 - 12. Weight Loss, ASTM C 1246, after heat aging: less than 10 percent
 - 13. Tack-Free Time, ASTM C 1246: 90 minutes.
 - 14. Stain and Color Change, ASTM C 510: Passes, no visible stain.
 - 15. Bond Durability, ASTM C719, on aluminum and concrete: Passes, plus or minus 50 percent movement.
 - 16. Adhesion in Peel, ASTM C794:
 - a. Aluminum: 35 pli
 - b. Concrete: 36 pli
 - 17. VOC Content:

- a. MasterSeal NP 150: 13.6 g/L, less water and exempt solvents.
 - b. MasterSeal NP 150 Tint Base: When mixed, 28 g/L, less water and exempt solvents.
18. Design Requirements:
- a. Design number of joints and joint widths for maximum of plus or minus 50 percent movement.
 - b. Design depth of sealant to be 1/2 width of joint.
 - c. Maximum Depth: 1/2 inch (13 mm).
 - d. Minimum Depth: 1/4 inch (6 mm).
 - e. Maximum Recommended Width: 1-1/2 inches (38 mm).
19. Manufacturers:
- a. Master Builders Solutions; MasterSeal NP150: www.master-builders-solutions.com/en-us/#sle.
- E. Interior Concealed Perimeter Sealant: Silicone; ASTM C 920, Type S, Grade NS, uses NT, G, M, A and O; single component.
1. Applications: Use for:
 - a. Concealed Joints between door/windows and adjacent materials.
 - b. Concealed Joints between metal frames and other materials.
 2. Color: White.
 3. Products:
 - a. Dow Corning Corporation; 758 Silicone Weather Barrier Sealant: www.dowcorning.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Applications: Use for:
 - a. Exposed Interior wall and ceiling control joints, painted
 - b. Exposed Joints between door and window frames and wall surfaces, painted.
 - c. Other interior paintable joints for which no other type of sealant is indicated.
 2. Color: Standard colors matching finished surfaces, Type OP (opaque).
 3. Manufacturers:
 - a. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - b. Bostik Inc: www.bostik-us.com.
 - c. Pecora Corporation; AC-20 +Silicone: www.pecora.com/#sle.
 - d. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Acoustical Sealant:
1. Applications: Use for concealed locations only:
 - a. Sealant bead installed at perimeter of wall and ceiling and at joints.
 2. Exposed and Concealed Joints:
 - a. Tremco, Inc.; Tremco Acoustical Sealant: www.tremcosealants.com.
 - b. U.S. Gypsum; "Sheetrock" Acoustical Sealant.: www.usg.com
 - c. Hilti CP 506 (not fire rated); www.hilti.com.
 - d. Hilti CP 606 (fire rated); www.hilti.com.

- e. 3M Fire Barrier 1000 N/S; www.3M.com.
- f. 3M Fire Barrier 2000 (fire rated and paintable with primer); www.3M.com.
- g. Substitutions: See Section 01 60 00 - Product Requirements.
3. Concealed Joints:
 - a. Dow Sill; 790 Silicone Building Sealant: www.dow.com.
 - b. Tremco, Inc; Tremco Acoustical Sealant: www.tremcosealants.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
4. Sheet Caulking:
 - a. Lowry and Associates: Lowry's Electrical Box Sealers; www.halory.com.
 - b. Tremco, Inc.; Tremco sheet caulking Fire Stop Putty Pads: www.tremcosealants.com.
 - c. Hilti Corp.; CP-617 Firestop Putty Pads: www.hilto.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Structural Sealant Adhesive: Neutral curing, silicone sealant formulated in compliance with ASTM C1184.
 1. Adhesive in compliance with ASTM C920; Type M - Multicomponent, Grade NS, Class 50, Use NT, G, and A.
 2. Ultimate Tensile Strength: Minimum of 50 psi as determined by test method ASTM C1135 under the following conditions.
 - a. Exposure to air temperatures of 190 degrees F and minus 20 degrees F.
 - b. Water Immersion for seven days, minimum.
 - c. Exposure to weathering for 5,000 hours, minimum.
 3. Sealant Design Tensile Strength: 20 psi, maximum.
 4. Hardness: 20 to 60 with Type A-2 durometer in compliance with test method ASTM C661.
 5. Color: Black.
 6. Volatile Organic Compound (VOC) Content: Less than 2.67 oz/gal.
 7. Manufacturers:
 - a. Dow Chemical Company; DOWSIL 995 Silicone Structural Glazing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - b. Momentive Performance Materials, Inc, exclusive licensee of General Electric: www.siliconeforbuilding.com/#sle.
 - c. Tremco Inc: www.tremcosealants.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 SELF-LEVELING SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Color: Gray.
 3. Manufacturers:
 - a. BASF Construction Chemicals-Building Systems; Sonolastic SL 1: www.buildingsystems.basf.com.
 - b. Tremco Global Sealants; THC-900: www.tremcosealants.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Bi-Cellular: Polyethylene foam rod, 25 to 33 percent larger in diameter than joint width.
 - 2. Manufacturers:
 - a. Bi-Cellular:
 - 1) Backer Rod Mfg, Inc.; Titan Foam.
 - 2) Nomaco, Inc; SOF ROD; www.nomaco.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Joint Protection:
 - 1. Manufacturer: Weathercap, Inc.
 - a. Material: Soft Lead.
 - b. Profile: Type A.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- E. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- F. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- G. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
 - 4. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
 - 6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's written instructions.
- C. Perform preparation in accordance with manufacturer's written instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete and Masonry:
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, or mechanical abrading; remove loose particles from cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 2. Where surfaces have been treated, remove surface treatment by sandblasting or wire brushing.
 - 3. Remove laitance and mortar from masonry joint cavities
 - 4. Remove laitance and form-release agents from concrete.
- F. Metal surfaces:
 - 1. Clean steel surfaces with metal or wire brush to remove mill scale and rust.
 - a. Prime surfaces as recommended by manufacturer.
 - 2. Clean nonporous surfaces with chemical cleaner which leaves no residue to remove oil and grease, and protective coatings, wiping surfaces with clean rags.
- G. Protect elements surrounding the work of this section from damage or disfigurement.
 - 1. Use tape or other materials recommended by manufacturer to prevent contact of sealant with adjoining surfaces that would otherwise be permanently stained or damaged by such contact or by cleaning methods to remove sealant smears.
 - 2. Concrete sealed with water repellent. Protect joints prior to applying sealer or apply sealer after sealant is installed and cured.
- H. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Prepare Job Site Daily Log Reports.
- B. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- C. Perform installation in accordance with manufacturer's written instructions and ASTM C1193.
- D. Perform acoustical sealant application work in accordance with ASTM C919.
- E. Sealant Backings:
 - 1. Install material to uniform depth below sealant.
 - 2. Using tool, smoothly and uniformly place backup material to depth of approximately 1/2 joint width (1/4 inch minimum), compressing backup material 25 percent to 50 percent and securing a positive fit.
 - 3. Do not leave gaps between ends of sealant backings.
 - 4. Do not stretch, twist, puncture, or tear sealant backings.

- F. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
 - 1. Width/depth ratio of 2:1.
 - 2. Neck dimension no greater than 1/3 of the joint width.
 - 3. Surface bond area on each side not less than 75 percent of joint width.
- G. Install bond breaker backing tape where backer rod cannot be used.
- H. Primers: Use primer approved by manufacturer for substrates being sealed, in accordance with manufacturer's recommendations.
- I. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- J. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- K. Mask joints where appearance of primer or sealant on adjacent surfaces would be objectionable.
 - 1. Provide dams where necessary to contain sealant.
 - 2. Remove masking tape immediately after tooling without disturbing joint seal.
- L. Tool joints concave.
 - 1. Provide uniformly smooth joints with slightly concave surface, flush at edges with adjacent surface, according to ASTM C1193, unless otherwise indicated.
 - 2. Do not use tooling agent unless specifically recommended in writing by sealant manufacturer.
 - 3. Leave sealant surface neat and smooth.
- M. Where possible, electrical boxes on either side of a wall, such as those for outlets and light switches, should be placed at least one stud spacing apart (e.g. 24"). Where electrical boxes on opposite sides of a wall must be placed closer together, the boxes should be covered completely with putty pads including at the junction with the gypsum board. In walls rated STC 60 or higher, all electrical boxes should be completely covered with putty pads.

3.04 FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
 - 1. Contractor to perform testing.
- B. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.
 - 1. Attendees for test meeting:
 - a. Sealant manufacturer's technical representative.
 - b. Contractor
 - c. Installer
 - d. Architect
 - 2. Initial Performance Testing:
 - a. Minimum four (4) locations and minimum two (2) at window perimeters in accordance with ASTM C1193 and as determined by Architect.

- 1) Prepare substrate surface for sealant application.
 - 2) Install sealant joint.
 - 3) Allow proper sealant cure time.
 - 4) Knife cut across sealant joint and two inches along each side of joint.
 - 5) Pull sealant out of joint at angle less than 90 degrees from cut piece and joint.
3. Follow-up Testing:
 - a. First 1000 Linear Feet: One test every 100 linear feet as soon as sealant is cured.
 - b. After first 1000 linear feet, if good results occur in first 1000 linear feet.
 - 1) One test per 1000 linear feet.
 - 2) One test per floor per elevation.
 - 3) One test per week per installation crew.
 4. Testing Documentation:
 - a. Date and location.
 - b. Installed age of sealant.
 - c. Test result, sealant failure type and degree of force (much or little).
 - d. Dimension of bead configuration.
 5. Test Success: Sealant separates from itself, cohesive failure, adhering to substrate and failing in bond to itself.
 6. Test Failure: Sealants from substrate, failing in bond to substrate, adhesive failure.
 - a. Repair field adhesion tests immediately after determining and documenting results.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
 - D. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 01 Section "Closeout Procedures".
3. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
4. Division 08 Section "Flush Wood Doors".
5. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
6. Division 08 Section "Door Hardware".
7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
8. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
9. Division 28 Section "Access Control Hardware".

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.

6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Pioneer Industries (PI).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 38 percent.

- D. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

- a. Curries Company (CU) – M Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

- a. Curries Company (CU) - C Series.
- b. Curries Company (CU) - M Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-

performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
9. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
 - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
 - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
 - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.

10. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 11. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 12. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 13. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and

- secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

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END OF SECTION 081113

SECTION 08 12 14
PREFINISHED STEEL DOOR FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire-rated and non fire-rated prefinished steel door frames for interior applications.

1.02 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.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.
- C. Submit manufacturer's product data showing details of design and construction and printed instructions covering installation.
- D. Samples: Submit selection and verification samples for finishes, colors and textures.
 - 1. Submit sample of each door frame type.
 - 2. Submit color charts samples of prefinished components indicating standard and custom colors selections. Include samples of custom color matches on base metal.
- E. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures..
 - 1. Indicate frame elevations, reinforcement, anchor types and spacings and location of cut-outs for hardware.
- F. Certificates: Certify that products of this section meet or exceed specified requirements.
- G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Manufacturer's Instructions: Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- A. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
- D. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver materials on manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Factory package door frame individually with surfaces protected against shipping and handling damage until time of installation.
- C. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- D. Store frames in dry, protected area off ground. Do not cover with tarp. Do not create a moisture chamber over product in storage.

1.06 FIELD CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress schedule to avoid construction delays.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 3 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Timely Industries, A Division of SDS Industries, Inc; www.timelyframes.com.
- B. Rediframe Products, a Division of The Dunbarton Corporation; www.dunbarton.com.
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PRODUCTS:

- A. Frames: Non-rated and Fire rated frames.
 - 1. "S" Series Frames, 20 gauge.
- B. Side Light Frames: 18 gauge.
- C. Casings: Manufacturer's standard.
 - 1. Standard Casings: 22 gauge prefinished steel.
 - 2. Provide casings with corner alignment clips.
- D. Light Openings:
 - 1. Provide frames for light openings same as door frame with flush rectangular beads.
 - 2. Frame for Fire Rated Openings: Metal frames and metal glazing clips approved for use in fire-rated opening of fire rating indicated.

2.03 ACCESSORIES

- A. Reinforcement Bracket for Closer: Manufacturers standard for application.
- B. Reinforcement Brackets for Rim Exit Device: Model TA-12.

- C. Reinforcement Brackets for Door Guards: Model TA-10.
- D. Glass Stops: Model TA-14 removable rolled steel, shape, butted ends, countersink style and screws.
- E. Silencers: Vinyl, clear stick-on type.
- F. Fasteners:
 - 1. Interior Frames: Drywall type.
 - 2. Site Applied Wood Trim: Finish type.

2.04 MATERIALS:

- A. Form interior door frames of ASTM A1008/A1008M commercial quality cold rolled steel.
- B. Form exterior door frames of electrogalvanized steel.

2.05 FABRICATION

- A. Frames: Fabricate frames as indicated on shop drawings.

2.06 FINISHES

- A. Door frames and sidelites.
- B. Prefinished with factory applied impact-resistant, polyester baked enamel finish in manufacturer's finish colors as selected:
- C. Finish Color: Custom color as selected by Architect
- D. Touch-up Paint: Provide aerosol touch-up paint for after-installation, on site repair as recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Verify rough openings sizes and wall thickness are acceptable.
- C. Verify finish hardware requirements for each opening; verify frame reinforcement, preparation and anchorage. Verify requirements and coordinate with door and hardware supplier.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Steel Door Frames:
 - 1. Install frames plumb and square, per shop drawings and manufacturers printed instructions.
 - a. Verify opening and dimensions with the shop drawings.
 - b. Use door as a template to insure proper alignment and clearances.
 - 2. Install frames over finished walls and anchor through faces in structure as indicated on drawings.

- C. Comply with manufacturer's recommendations for fasteners every 11 inches minimum.
- D. Secure frame to wall with appropriate type fasteners. Install casing on the frame.
- E. Anchor frame with one drywall-type screw adjacent to each casing clip.
- F. Use pre-fit template door actual door in opening to ensure proper alignment and clearances.
- G. Align parts with proper clearances to ensure proper fit, tight miters and performance requirements.
- H. Install silencers on interior door frames.
- I. Adjust strike plate to hold door tight to stops when closed.

3.03 FINAL INSPECTION:

- A. Inspect each opening for operation, hardware, appearance and installation. Make required adjustments.
- B. Replace frames defective under terms of manufacturer's warranty.

3.04 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas.
- B. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.
- C. Repair or replace damaged installed products.
- D. Remove from jobsite refuse and debris created and dispose per Section 01 74 19.

3.05 PROTECTION

- A. Protection: Protect installed product's finish surfaces from damage during construction.
- B. Repair or replace all damaged or defective frames
- C. Touch-up paint all damaged areas of factory applied finishes with aerosol spray cans of same paint as used in the factory.

END OF SECTION

**SECTION 08 14 16
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.
- B. Interior solid and hollow core flush wood swing, bi-pass, and pocket doors.

1.02 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. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- D. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- F. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- G. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Test Reports: Show compliance with specified requirements for the following:
 - 1. Rated assemblies listing and approval by authority having jurisdiction for the following:
 - a. Fire protection rating label for doors and frames.
 - b. Smoke control "S" label for door and frame assemblies.
 - c. Temperature rise label for doors.
- D. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.
 - 1. Details of door construction, including core and edge construction and trim for openings.
 - 2. Indicate net door clearance for doors on accessible path per ICC A117.1 or as indicated on drawings.
- E. Door Schedule: Use same reference numbers for details and openings as those in Contract Drawings.
 - 1. Indicate coordination of glazing frames and stops with glass and glazing requirements.
- F. Oversize Construction Certification: For fire rated door assemblies that exceed limitations of labeled assemblies, submit certification that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

- G. Manufacturer's Installation Instructions: Indicate special installation instructions.
- H. Warranty, executed in Owner's name.

1.04 REGULATORY REQUIREMENTS

- A. Fire-Rated Wood Doors: Provide doors complying with NFPA 80 that are listed and labeled for fire ratings indicated, base on testing according to NFPA 252.
- B. Fire door assemblies shall be labeled for fire resistance and smoke control ("S" label) in accordance with NFPA 252 and UL 10C.
 - 1. Meet appropriate Factory Mutual, Underwriters Laboratories, or Warnock Hersey requirements and have acceptance label permanently attached to each fire door assembly.
- C. For stair doors, and where indicated or required by Building Code in exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

1.05 QUALITY ASSURANCE

- A. Use skilled workers trained and experienced in necessary crafts and familiar with requirements and methods needed for proper performance of the Work.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.
 - 1. Stack flat on 2 x 4 lumber, laid 12 inches from ends and across center.
 - 2. Under bottom door and over top of stack, provide plywood or corrugated cardboard to protect door surfaces.
- D. Handling: Do not drag doors across one another; lift doors and carry them into position. Handle with clean gloves.
- E. Store 7 days minimum at building temperature and humidity before installing.

1.07 PROJECT CONDITIONS

- A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 ENVIRONMENTAL CONDITIONS

- A. Maintain 50 degrees F or above in areas where wood doors are installed.
- B. Maintain 30 percent minimum to 60 percent maximum humidity in areas where wood doors are installed.

1.09 COORDINATION

- A. Coordinate with other trades as required to assure proper and adequate provision in work of those trades for interface with work of this Section.
 - 1. Coordinate doors to receive hardware specified in Section 08 71 00.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Provide warranty for the following term:
 - 1. Interior Doors: Life of installation.
 - 2. Replace, rehang and refinish without any additional cost to Owner any delaminated doors or any doors exceeding tolerance limits.
- D. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Algoma hardwoods, Inc: www.algomahardwoods.com.
 - 2. Eggers Industries: www.eggersindustries.com/#sle.
 - 3. Lynden Doors, Inc: www.lyndendoor.com.
 - 4. Mohawk Flush Doors, Inc; www.mohawkdoors.com.
 - 5. Masonite Architectural: www.architectural.masonite.com/#sle.
 - 6. Vancouver Door Company, Inc; www.vancouverdoorco.com.
 - 7. VT Industries, Inc: www.vtindustries.com.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND PANELS

- A. Requirements for Doors and Frames:
 - 1. Accessibility: Comply with ANSI/ICC A117.1.
 - 2. Door Edge Profile: Beveled on both edges.
- B. Doors: See drawings for locations and additional requirements.
 - 1. Quality Level: Premium Grade, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.
 - 2. Wood Veneer Faced Doors: Hot process, 5-ply unless otherwise indicated.
- C. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Types: Provide the following types, as scheduled:
 - a. Flush Face.
 - 3. Sizes and Relites: See Door Schedule.

4. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
5. Wood veneer facing for field transparent finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
- C. Hollow Core Doors: Type - Standard (FSHC); plies and faces as indicated above.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Vertical Grain Fir, Select grade, rift cut, with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
 1. Vertical Edges: Any option allowed by quality standard for grade.
- B. Facing Adhesive: Type I - waterproof.

2.05 DOOR FRAMES

- A. Facing for Opaque Finish: Close grain hardwood.
- B. Fire Rating: Same as doors.

2.06 SLIDING BARN DOOR

- A. Door: Wood, Flush panel, Stain grade veneer.
- B. Hardware:
 1. Product: Pemko Model W60, Single wheel design.
 2. Finish: US32D
 3. Mounting Style: Top.

2.07 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
- C. Bond edge banding to core with adhesive.
- D. Provide solid blocks at lock edge for hardware reinforcement.
- E. Fit door edge trim to edge of stiles after applying veneer facing.
- F. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- G. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

- H. Provide edge clearances in accordance with the quality standard specified.
- I. Machine and hand sand exposed surfaces.

2.08 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. System - 12 Polyurethane Water-based.
 - b. Sheen: Satin.
 - B. Factory finish doors in accordance with approved sample.
 - C. Seal door top and bottom edges with color sealer to match door facing.

2.09 ACCESSORIES

- A. Glass: As specified in Section 08 80 00
 - 1. Glass in Fire Rated Doors: Use materials and assemblies qualified by tests in accordance with Building Code and Door Manufacturer.
- B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- C. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
 - 1. Correct conditions detrimental to timely and proper completion of Work.
 - 2. Do not proceed until unsatisfactory conditions are corrected.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 COORDINATION

- A. Coordinate to assure proper and adequate provision of Work and interface other trades.
- B. Protect work of others from damage.

3.03 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions, quality standard and as specified.
 - 1. Contract Documents.
 - 2. Reviewed Shop Drawings.
 - 3. Requirements of governmental agencies having jurisdiction.
 - 4. Install fire-rated doors in accordance with NFPA 80 requirements.
 - 5. Install smoke control doors with frames that have been constructed and tested as an assembly in accordance with Building Code and approved for "S" label.

- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Field-Finished Doors: Trimming to fit is acceptable.
 - 1. Adjust width of non-rated doors by cutting equally on both jamb edges.
 - 2. Trim maximum of 3/4 inch off bottom edges.
 - 3. Trim fire-rated doors in strict compliance with fire rating limitations.
 - 4. Seal trimmed edges in accordance with manufacturer recommendation.
- D. Fitting and machining:
 - 1. Tolerances:
 - a. Bottom: 1/4 inch clearance maximum.
 - b. Top: 1/8 inch clearance maximum.
 - c. Lock edge and hinge edge: Bevel 1/8 inch in 2 inches maximum.
- E. Use machine tools to cut or drill for hardware.
- F. Coordinate installation of doors with installation of frames and hardware in accordance with recommendations of manufacturers.
 - 1. See Section 08 71 00 for additional hardware.
- G. Coordinate installation of glazing.
- H. Replace or rehang doors which are hinge bound and do not swing or operate freely or are not flush with frame face when closed.
 - 1. Door left in any position of its swing shall hold.

3.04 COMPLIANCE

- A. Owner reserves right to request and pay for inspection by a representative of reference organization to determine that Work of this Section has been performed in accordance with specified standards.
- B. In event inspection determines Work of this Section does not comply with specified requirements, immediately remove non-complying items and replace with items complying with specified requirements, at no additional cost to Owner, and reimburse Owner for cost of inspection.

3.05 TOLERANCES

- A. Comply with specified quality standard for telegraphing, warp, and squareness.
- B. Squareness: 1/8 inch maximum difference between 2 diagonal measurements.
- C. Maximum Vertical Distortion (Bow): 1/8 inch 1/4 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.
- D. Maximum Width Distortion (Cup): 1/8 inch 1/4 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.06 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

- C. During warranty period, check, adjust and service moving parts to operate smoothly and quietly.
 - 1. Adjust weatherstripping, gaskets, and door bottoms for correct clearance.

3.07 CLEANING

- A. Clean, without damaging, exposed surfaces affected by Work of this Section, and repair as necessary.
- B. Remove from jobsite refuse and debris created and dispose per Section 01 74 19.

3.08 SCHEDULE - SEE DRAWINGS

END OF SECTION

**SECTION 08 14 23
CLAD WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clad wood doors.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 09 91 23 - Interior Painting: Field finishing of doors.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2022.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2021, with Errata (2022).
- D. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork 2019.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Performance Validation: Submit certified label or test report on products as indicated under performance requirements to validate product compliance.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.

- C. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Doors with Exterior Aluminum Cladding and Interior Wood Facing:
 - 1. Kolbe Wood Windows; Product; VistaLuxe WD 3-panel slider, and matching swing door; www.kolbewindows.com.

2.02 COMPONENTS

- A. Exterior Clad Wood Doors: Water-repellent and preservative-treated lumber in accordance with WDMA I.S. 4.
 - 1. Thickness: 1-3/4 inches, unless otherwise indicated.
 - 2. Exterior Door Cladding: Aluminum sheet as indicated.
 - 3. Interior Wood Facing, Transparent: Wood veneer with factory finish as indicated.
- B. Configuration: As indicated on drawings.
- C. Door Product Type: SHD - Side-hinged door, in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
 - 1. Apply silicone glazing sealant to exterior glazing stops as recommended by manufacturer.
 - 2. Apply water repellent treatment to wood glazing stops.
- E. Door Stops: Clear preservative treated wood, finished to match frame.
- F. Door Hardware: Manufacturer's standard.
 - 1. See Section 08 71 00 for balance of hardware not provided by door manufacturer.

2.03 DOOR INTERIOR WOOD FACINGS

- A. Veneer Facing for Transparent Finish: Red Oak, veneer grade in accordance with requirements indicated, and plain sliced (flat cut), with book match between leaves of veneer, and running match of spliced veneer leaves assembled on door or panel face.
- B. Door Edging: Any option allowed by quality standard for grade.
- C. Wood Finish: Factory applied clear satin polyurethane coating over natural wood.
 - 1. Field finish doors, see Section 09 91 23.
- D. Facing Adhesive: Type I - waterproof.

2.04 DOOR EXTERIOR CLADDING

- A. Aluminum Cladding: 6063-T5 aluminum cladding on exterior side, 0.045 inch minimum thickness, factory fabricated, factory glazed; complete with integral sloped sill/threshold, flashings, and anchorage devices.
- B. Exterior Aluminum Finish: Superior performing organic coatings.
 - 1. Color: Black.
- C. Aluminum Members: Factory finished; solid corner construction; thermally broken.
- D. Drainage: Provide drainage to exterior for moisture entering joints and glazing spaces and for condensation occurring within frame construction.

2.05 PERFORMANCE REQUIREMENTS

- A. Comply with AAMA/WDMA/CSA 101/I.S.2/A440 requirements in accordance with the following:
 - 1. Performance Class (PC): R.
- B. Performance Validation: Side hinged doors (SHD) in compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance requirements as indicated, or an independent test report for indicated products itemizing compliance and acceptable by authorities having jurisdiction.
- C. Design Pressure (DP): In accordance with ASCE-7 and as noted on Structural General Notes..

2.06 FABRICATION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- D. Cut and configure exterior door edge to receive recessed weatherstripping devices.
- E. Provide edge clearances in accordance with the quality standard specified.

2.07 FACTORY FINISHING - WOOD VENEER INTERIOR FACE

- A. Finish work in accordance with WDMA I.S. 1A for Grade specified and as follows:
 - 1. Transparent:
 - a. System - TR-2, Catalyzed Lacquer.
 - b. Sheen: Flat.

2.08 ALUMINUM FINISHES

- A. Superior Performing Organic Coatings: AAMA 2605, multiple-coat, thermally-cured polyvinylidene fluoride system.
- B. Color: As indicated on the drawings.

2.09 ACCESSORIES

- A. Door Astragals: Thickness, wood species, and interior and exterior finishes to match door; provide with weatherseals.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Assemble multiple units before installation in accordance with manufacturer's installation guidelines.
- C. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- D. Field-Finished Doors: Trimming to fit is acceptable.
 - 1. Adjust width of doors by cutting equally on both jamb edges.
 - 2. Trim maximum of 3/4 inch off bottom edges.
- E. Use machine tools to cut or drill for hardware.
- F. Coordinate installation of doors with installation of integral frames and hardware.
- G. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 CLEANING

- A. Clean units using cleaning material and methods in accordance with door manufacturer's written recommendations.

3.06 PROTECTION

- A. Protect installed work from damage due to subsequent construction activity on the site.

3.07 SCHEDULE - SEE DRAWINGS

END OF SECTION

**SECTION 08 31 00
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall-mounted access units.
- B. Ceiling-mounted access units.

1.02 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products Current Edition.
- B. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate size and location of access door units.
 - 1. Schedule each access door unit and include the following information:
 - a. Size.
 - b. Fire rating, if any.
 - c. Panel and frame finish
 - d. Locking type, if applicable

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated access doors.
 - 1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.
- B. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.

1.05 PROJECT CONDITIONS

- A. Coordinate the work with other work requiring access doors.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Panel Material: Aluminum extrusions with gypsum board inlay.
 - 2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 3. Products:
 - a. In Gypsum Board on Steel Studs:
 - 1) Model DW manufactured by Milcor Inc.

- B. Fire-Rated Wall-Mounted Units:
 - 1. Wall Fire-Rating: As indicated on drawings.
 - 2. Panel Material: Steel.
 - 3. Products:
 - a. In Gypsum Board on Steel Studs:
 - 1) Model UFR manufactured by Milcor Inc.
- C. Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Panel Material: Aluminum extrusion with gypsum board inlay.
 - 3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
 - 4. Size - Other Ceilings: 12 by 12 inches.
 - 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- D. Fire-Rated Ceiling-Mounted Units:
 - 1. Ceiling Fire-Rating: As indicated on drawings.
 - 2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 3. Products:
 - a. In Gypsum Board on Metal Furring:
 - 1) 1 hour fire rating.
 - 2) Model UFR manufactured by Milcor Inc.
 - (a) Description: Downward swing.

2.02 WALL-MOUNTED ACCESS UNITS WITH RETURN AIR GRILLES

2.03 FABRICATION

- A. Weld, fill, and grind joints to ensure flush and square unit.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Verify clearance for door swing and door access to required equipment.

3.02 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.

3.03 ADJUSTING AND CLEANING

- A. Adjusting Defective Work: Repair scratched door surfaces to match factory prime finish.
- B. Final Cleaning: Clean door and frame surface prior to field painting.
- C. Remove from jobsite refuse and debris created and dispose per Section 01 74 19.

END OF SECTION

**SECTION 08 33 23
OVERHEAD COILING DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior coiling doors.
- B. Electric operators and control stations.
- C. Exterior door with insulated slats.
- D. Wiring from electric circuit disconnect to operators and control stations.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- B. ITS (DIR) - Directory of Listed Products Current Edition.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- E. NEMA MG 1 - Motors and Generators 2021.
- F. UL (DIR) - Online Certifications Directory Current Edition.
- G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

1.03 DESIGN REQUIREMENTS

- A. Motor Operation: Automatic reset with built-in battery & voice module.
- B. Service Cycles:
 - 1. Cycles per day: 25
 - 2. Cycles for life of door: 100,000

1.04 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

1.05 DOCUMENTATION FOR ON-SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for On-Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.

- C. Retain the following documentation for on-site information:
 - 1. Manufacturer's written instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.
 - 2. Coordination Drawings.

1.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.
 - 2. Operation and maintenance data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.
 - 3. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 4. Submittals for On-Site information
 - 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.07 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified and indicated.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide two year manufacturer warranty for defects in workmanship and materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Overhead Coiling Doors:
 - 1. Basis of Design: Cornell Iron Works, Inc; Product Thermiser Rolling Door: www.cornelliron.com.
 - 2. The Cookson Company: www.cooksondoor.com/#sle.
 - 3. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com/#sle.
 - 4. Clopay Building Products: www.clopaydoor.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COILING DOORS

- A. Exterior Coiling Doors: Steel slat curtain.
 - 1. Capable of withstanding positive and negative wind loads of 20 psf without undue deflection or damage to components.
 - 2. Sandwich Slats: Manufacturer's standard, with core of foamed-in-place polyurethane insulation; minimum R-value of that indicated on drawings.

3. Nominal Slat Size: 3 inches wide by required length.
4. Finish: Factory painted, color as selected.
5. Guide, Angles: Galvanized steel.
6. Hood Enclosure: Manufacturer's standard; primed steel.
7. Electric operation.
8. Mounting: As indicated on drawings.

2.03 MATERIALS AND COMPONENTS

- A. Metal Curtain Construction: Interlocking slats.
 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 2. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
 - a. Provide tapered curtain bottom at sloped grade.
 3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
 4. Steel Slats: Minimum thickness, 22 gauge, 0.336 inch; ASTM A653/A653M galvanized steel sheet.
- B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.
- C. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
 1. Prime painted.

2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
- B. Electric Operators:
 1. Mounting: Side mounted.
 2. Motor Enclosure:
 - a. Exterior Coiling Doors: NEMA MG 1, Type 4; open drip proof.
 3. Motor Rating: 1/2 HP; continuous duty.
 4. Motor Voltage: 460 volts, three phase, 60 Hz.
 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - a. Motor and controls shall be U.L. approved for use with fire doors.
 6. Controller Enclosure: NEMA 250, Type 4.
 7. Opening Speed: 12 inches per second.
 8. Brake: Manufacturer's standard type, activated by motor controller.
 9. Manual override in case of power failure.
 10. See Section 26 05 83 for electrical connections.
- C. Control Station: Provide standard three button, 'Open-Close-Stop' momentary-contact control device for each operator complying with UL 325.
 1. 24 volt circuit.
 2. Surface mounted, at interior door jamb.

3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
 - b. Secondary Device: Provide electric sensing edge with wireless edge kit or non-monitored safety edge as an option along with continuous-constant control device.
- D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that adjacent construction is suitable for door installation.
- B. Verify that electrical services have been installed and are accessible.
- C. Verify that door opening is plumb, header is level, and dimensions are correct.
- D. Notify Architect of any unacceptable conditions or varying dimensions.
- E. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Division 26.
- F. Complete wiring from disconnect to unit components.
- G. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.
- H. Install enclosure and perimeter trim.
- I. Field apply finish paint as specified in Section 09 91 13 - Exterior Paint and 09 91 23 - Interior Paint.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.04 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.
- C. Remove, dispose and recycle debris from project site per Section 01 7419.

END OF SECTION

**SECTION 08 34 15
SMOKE CONTAINMENT SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Smoke Containment Unit with reinforced polyamide plastic film smoke containment curtain, control station, sheet metal container, rewind switch, and accessories as required for complete, operational installation.

1.02 REFERENCE STANDARDS

- A. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents 2021.
- B. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting 2018.
- C. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test) 2008, with Editorial Revision (2015).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- E. ASTM D1183 - Standard Test Methods for Resistance of Adhesive to Cyclic Laboratory Aging Conditions; 2003 (Reapproved 2011).
- F. ICC-ES AC77 - Acceptance Criteria for Smoke-Containment Systems Used with Fire-resistance-rated Elevator Hoistway Doors and Frames and at the Intersection of Elevator Lobby and Corridor 2013, with Editorial Revision (2017).
- G. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
- H. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.
- I. UL 864 - Control Units and Accessories for Fire Alarm Systems Current Edition, Including All Revisions.
- J. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.03 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.

1.04 SUBMITTALS

- A. As specified in Section 01 30 00.
- B. Submit manufacturer's complete product data and installation instructions
- C. Shop Drawings:
 - 1. Indicate the following:
 - a. Anticipated Date of Installation.
 - b. Elevator Lobby ceiling height.

- c. Hoistway door opening width.
 - d. Hoistway door opening height.
 - e. Hoistway door frame profile, projection from finished wall and face width.
 - f. Hoistway door frame material and existing finish.
 - g. Mounting height.
 - h. Any projections from lobby wall within 12 inches of hoistway door frame, floor to ceiling.
- D. Cycle Testing:
- 1. Before smoke containment systems are placed into use, perform acceptance tests as required and recommended by Building Code and governing authorities.
- E. Permits and Manuals:
- 1. Furnish certificates or operating permits to Owner as required by governing authorities, and furnish copies of maintenance manual with operating and maintenance instructions, emergency information, and similar information
 - 2. Instruct Owner's personnel in proper operation and required semi-annual maintenance.

1.05 QUALITY ASSURANCE

- A. Maximum Air Leakage Rate: Less than 1 cfm per square foot at 0.3 in. wg pressure at 400°F.
- B. Maximum Temperature Necessitating Replacement: System must be replaced after exposure to temperatures exceeding 200° F
- C. Products shall be free of defects in workmanship and material, and when properly installed and maintained, will perform in accordance with the specifications set forth in ICC-ES AC77.
- D. Product Recognition
 - 1. Each smoke-containment system shall be identified as follows:
 - a. Manufacturer's name.
 - b. Maximum leakage rating at the specified pressure and temperature conditions.
 - c. Label of the approved quality control agency.
 - d. ICC ES evaluation report number.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver system to project site in sealed containers.
- B. Store system under cover and elevated above grade.

1.07 WARRANTY

- A. Warranty shall be in effect for a period of twelve (12) months from the date of substantial completion.
- B. Provide service and maintenance of smoke containment system every 6 months from Date of Substantial Completion for one year or as required by the Authority Having Jurisdiction (AHJ).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: US Smoke & Fire; www.ussmokeandfirecurtain.com.

1. Model: SD60GS.
- B. Smoke Guard, A CSW Industrials Company; www.smokeguard.com.
 1. Model: M400.
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. System shall be manufactured under a quality control program meeting requirements of ICC ES Acceptance Criteria for Quality Control Manuals.
- B. Meet or exceed standards outlined in following tests:
 1. Reinforced film:
 - a. ASTM E84 Surface Burning Characteristic producing a flame-spread index less than 25 and a smoke-developed rating less than 50.
 - b. ASTM D543 Resistance of Plastics to Chemical Reagents maintaining its physical properties after exposure to Hydrochloric Acid at a pH 1, Sodium Hydroxide at a pH 10, Kerosene and Paint Thinner when tested in accordance with ASTM D882 Tensile Properties of Thin Plastic Sheeting.
 - c. ASTM D1876 Peel Resistance of Adhesives maintaining a bond between the yarn and the film at least 2 pounds per inch.
 2. Smoke Containment System
 - a. UL 1784 Air Leakage Tests of Door Assemblies maintaining an air leakage rating of less than 1 cfm per square foot of opening when tested under both positive and negative pressure at both ambient and elevated (400° F/ 204° C) temperatures at a differential air pressure 0.3 inches water column.
 - b. Cycle Testing described in ICC-ES AC77 demonstrating no fatigue after completing 100 cycles. The system must continue to function without impairment.
 - c. Expansion Characteristics of less than 6 inches when tested under both positive and negative pressure at both ambient and elevated (400° F/ 204° C) temperatures at a differential air pressure of 0.3 inches water column
 - d. Opening Force less than 15 pounds per foot to disengage the system applied perpendicular to the plane of the film at the boundary.

2.03 MATERIALS

- A. Housing: 10 inch deep by 10 inch high rough opening (4 inches high x 10 inches wide rewind motor top or side mount) by various width, 20 gauge primed metal container with a primed metal hinged door and 12v DC rewind motor provided and installed by installer.
 1. Housing connected to backing plate mounted to face of hoistway wall.
 2. Provide clear paintable silicone sealant along bottom edge at wall after housing is set.
- B. Curtain Film: 1 mil thick transparent polyamide plastic film reinforced at 0.25 inches each way with a 100 denier nomex yarn.
 1. Curtain: Rolled around a 4 inch diameter aluminum cylinder.
 2. Flexible multi-pole magnetic strips: Energized ferrite in a nitrile rubber binder exerting a minimum force of 1.4 MGOe shall be attached to each longitudinal edge of the film.
 3. Magnets: Attached to film using a continuous bead of low modulus silicone sealant.

- C. Two 1/8 inch wide strips of 0.002-inch thick synthetic elastomer, two stage, laminating adhesive to be attached to the attaching face of the flexible magnets.
- D. Auxiliary Rail: Hoistway door frames that are non-ferrous, stainless steel, brass, bronze, aluminum or do not have a flat 2 inches face profile shall be provided with a 2 inch wide primed flat metal rail and sub rail mounted to hoistway wall directly outboard and adjacent to hoistway door frame.
 - 1. Provide clear paintable silicone sealant at inside and outside edge of rails after rails are set. Typical (2) for each smoke containment unit.
- E. Control Station: Single units: 16 inch x 10 inch x 5 inch NEMA approved box for each smoke containment unit provided and installed by installer.
 - 1. Grouped units on a common floor activated by a single smoke detector require a Multiple Activation Control Station (MACS) 20 inches x 10 inch x 5 inch NEMA approved box, and one additional control station for each additional unit provided and installed by installer.
- F. Motor: 12-volt DC unit powered by 120-volt AC power passing through a transformer.
 - 1. Emergency back-up power: 12-volt DC battery equipped with a charger.
- G. Release mechanism: Capable of deploying the smoke containment system in less than 10 seconds and comply with UUL 864.
- H. Rewind Switch: Spring type single or double pole switch, battery monitor LED and stainless steel cover plate provided by manufacturer and installed by installer.
 - 1. Multiple units on a common floor activated by a single smoke detector are limited to (2) units per rewind switch.
- I. System to be connected to the auxiliary contact circuit of the smoke detector (by others) complying with UL 268 equipped with an auxiliary power supply or an approved central smoke detection alarm system.
- J. System to be listed and labeled by an independent testing laboratory meeting the requirements of the ICC Evaluation Service.
- K. Each smoke-containment unit to be posted with a sign warning occupants not to exit through the smoke barrier.
- L. Cove Base: 24 gauge primed metal provided and anchored to floor directly in front of ferrous metal hoistway door frame or attached to auxiliary rails.
 - 1. Typical (2) for each smoke containment unit.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions and NFPA 105.
- B. Smoke-containment system to be installed by factory trained personnel.
- C. Provide following for each elevator hoistway door opening in accordance with code prior to installation of smoke containment system:
 - 1. Housing Mounting Area:
 - a. Provide a clear, level, and unobstructed area flush with the finished wall 14 inch high x full width of housing located above each elevator hoistway door.

- b. Shaftwall Construction: Provide and install 20 gauge metal backing full height and width of housing in each housing mounting area.
 - c. Remove trim and other objects that extend into swing path of housing door.
 - d. Remove ceiling and grid in area designated for housing and provide adequate working clearances and rough opening dimensions.
2. Curtain Installation Area:
 - a. Install lobby side of elevator shaft plumb, level, true, and straight with no distortions.
 - b. Remove obstructions and projections with housing width centered on hoistway door from bottom of housing to lobby floor.
 - c. Remove trim and projections within 3 inch beyond the outer edge of hoistway door frame or auxiliary rail.
 - d. Where auxiliary rails are required, hall call stations that are located within the area of auxiliary rails must be relocated.
 3. Control Station Area: Provide a clear, level, unobstructed, and accessible area located near each elevator hoistway door.
 4. Painting: Patch wall surfaces and provide a bead of clear paintable silicone sealant adjacent to the auxiliary rails, cove base and housing then shall paint all wall surfaces adjacent to housing and auxiliary rails.
 - a. Painting per Section 09 91 23, Interior Painting and as specified herein.
 - b. Do not field paint frame, auxiliary rails, cove base, housing, housing door or hinge without first contacting installer. Do not paint housing door shut or fill hinge with paint.
 - c. Field painting hoistway door frames, auxiliary rails, and cove bases will require stripping of existing paint to base metal and repainting with a sprayed 0.005 inch thick maximum paint resistant to 400° F. Use Valspar Hi-Heat Silicone Coatings or Sherwin Williams Flame Control 850 Series or manufacturer approved alternate.
 - d. Factory painted hoistway door frames do not need to be field painted.
 5. Access Panels: Provide full and permanent access to meet code at each control station and all junction boxes.
 6. Smoke Detector: Provide smoke detector complying with UL 268 at lobby ceiling per code, equipped with an auxiliary normally open contact and supplied with battery backup or emergency power. Smoke containment system is connected to the local detector, not the general alarm. No voltage shall exist across the auxiliary contact.
 7. Control Pull Box: Provide and install (1) Four-square deep box to pull smoke detector, rewind switch, and housing wiring through to the control station.
 8. 120 Volt AC Power: Locate 120v AC power junction box above each hoistway door in close proximity to the control station area where shown in the drawings. Contractor shall hard wire control station disconnect (provided by manufacturer) after control station is set by installer.
 9. Rewind Switch J-Box: Provide and install a four-square deep box with single gang mud ring for each smoke containment system in visual proximity of smoke containment system where directed by architect.
 10. Alarm Circuit: Provide and install from the normally open auxiliary contact of the lobby smoke detector to control station through control pull box.
 11. Rewind/Battery Circuit: Provide and install from rewind switch J-box through control pull box to control station. Double smoke containment systems on a common floor each

require rewind/ battery circuit from rewind switch box to each control station. Two smoke containment systems maximum per rewind switch.

12. Housing Control Circuit: Provide and install in flexible conduit from housing through control pull box to control station.
13. Control Circuit: Provide and install flexible conduit and wiring from control pull box to control station.
14. Housing J-Box: Provide by and installed by manufacturer.
15. Rewind Motor (top mount): Standard Motor provide and installed by manufacturer. Rewind motor draws 13.5 amps at 12v DC or approximately 1.5 amps at 120v AC.

3.02 CLEANING

- A. Remove, dispose and recycle debris from project site per Section 01 74 19.

END OF SECTION

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS (ASF)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Infill panels of glass.
- C. Aluminum doors and frames.
- D. Weatherstripping.
- E. Perimeter sealant.

1.02 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.
- B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.
- C. AAMA 513 - Standard Laboratory Test Method for Determination of Force and Motions Required to Activate Operable Parts of Operable Windows and Sliding Glass Doors.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- E. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2022.
- F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- K. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
- L. 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).
- 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 2023).

- N. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015 (Reapproved 2023).
- O. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.
- P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.
- Q. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. See Section 01 30 00 - Administrative Requirements, for pre-installation meeting procedures.
- B. Coordinate with installation of other components that comprise the exterior enclosure.
- C. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.04 SYSTEM DESCRIPTION

- A. Thermally broken storefront system, including compensating receptor, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units. Provide continuous thermal break of components from exterior to interior.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
 - 1. Accessible Force and Motion: Provide data operable windows and doors comply with AAMA 513.
- C. 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. Provide 3-dimensional drawings of intersecting pieces, cut away drawing showing air and water management systems and continuity of weather barrier systems.
 - 2. Shop drawings to include back angle gauge and size, back angle attachment to slab and back angle attachment to glazing system.
 - 3. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- D. Installation Instruction: Provide manufacturer project specific written installations.
- E. Test Reports:
 - 1. Prior to submitting shop drawings or starting fabrication, submit test report(s).
 - 2. Furnish test reports from accredited independent testing laboratory certifying that identical or larger storefront units meet requirements specified.
 - a. Air Infiltration, Water penetration, and Structural Performance: AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
 - b. Thermal performance: NFRC 100 (Assembly U-value) and NFRC 200 (Assembly SHGC).
 - c. Insulated Glass Seal Integrity: IGCC certified.

- F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations, stamped by an engineer licensed in the State where project is located post approved shop drawings.
- G. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- H. Installer Certificate: Provide letter from manufacture, indicating installer and company are approved to install storefront system for this application.
- I. Installer's Qualification Statement.
- J. Warranty: Submit manufacturer sample warranty.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components 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 Qualifications: Company specializing in performing work of type specified and with at least thirty (30) years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.
- C. Deliver, store, and handle per manufacturer's written instructions.

1.08 PROJECT CONDITIONS

- A. Coordinate the work with installation of firestopping components or materials.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units, material only.
- C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
 - 1. Anodized: Five (5) years.
 - 2. Superior Performing Organic Coatings System: Ten (10) years expandable to twenty (20) years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Kawneer Company Inc.; Product 451UT; www.kawneer.com.
- B. Other Acceptable - Aluminum-Framed Storefronts Manufacturers:
 - 1. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Center-Set Style, Thermally-Broken:
 - 1. Basis of Design: Kawneer Company, Inc; Product TriFab 451UT: www.kawneer.com.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/#sle.
- C. Substitutions: See Section 01 60 00 - Product Requirements.
 - 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.03 BASIS OF DESIGN -- SWINGING DOORS

- A. Medium Stile, Insulating Glazing, Thermally-Broken:
 - 1. Basis of Design: Kawneer; Product: 350 Heavy Wall Entrances; www.kawneer.com.
 - 2. EFCO Corporation; D302: www.efcocorp.com.

2.04 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory screw spline fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Rabbet: For 1 inch insulating glazing.
 - 2. Glazing Position: Centered (front to back).
 - 3. Finish: Superior performing organic coatings.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - 4. Finish Color: As selected by Architect from manufacturer's standard line.
 - 5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

2.05 PERFORMANCE REQUIREMENTS

- A. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 1. Design Wind Loads: Comply with requirements of ASCE 7 and as indicated on structural drawings.
 2. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
- B. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 10 psf.
- C. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283/E283M at 6.20 psf pressure differential across assembly.
- D. Thermal Resistance of Assembly (excluding vision areas): NFRC 100 certified U value of 0.32.
- E. Solar Heat Gain Coefficient (SHGC): 0.24, nominal.
- F. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly.

2.06 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 1. Glazing Stops: Flush.
 2. Cross-Section: As indicated on drawings.
 3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: See Section 08 80 00.
- C. Back Angle:
 1. Provide back angle as indicated on drawings, secure into window and substrate with fasteners.
 2. Size angle and fasteners to develop lateral connection at sill.
 3. Material Type and Fasteners: Stainless Steel or Aluminum.
 4. Size: 18 gauge minimum, 1-1/2 inch x 1-1/2 inch.
- D. Swing Doors: Glazed aluminum.
 1. Thickness: 2 inches.
 2. Top Rail: 6 inches wide.
 3. Vertical Stiles: 5 inches wide.

4. Bottom Rail: 10 inches wide.
 5. Glazing Stops: Square.
 6. Finish: Same as storefront.
- E. Head Compensating Receptor: Manufacturers standard unit for application.
1. End Dam Receptors: Provide at head compensating receptor, EPDM end dam receptor set in full bead of sealant to seal head compensating receptor to mullion to maintain air and water tightness.
- F. Operable Sash: Aluminum project-out awning; finished to match storefront; turn handle latch with manufacturer's standard insect screen.

2.07 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
- C. Fasteners: Stainless steel.
- D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.
- E. Concealed Flashings: 0.018 inch thick stainless steel.
- F. Perimeter Sealant: Type Silicone specified in Section 07 92 00.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- H. Glazing Accessories: See Section 08 80 00.
- I. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.08 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.
- B. Color: As indicated on drawings.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.09 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
 1. Finish on Hand-Contacted Items: Polished chrome.
 2. For each door, include butt hinges, pivots, push handle, pull handle, exit device, narrow stile handle latch, and closer.

2.10 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce framing members for imposed loads.
- G. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's written 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. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Install operating sash.
- J. Set thresholds in bed of sealant and secure.
- K. Install hardware using templates provided.
- L. Install perimeter sealant in accordance with Section 07 92 00, and per manufacturer's written installation instructions.
- M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 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.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- B. Exterior Assembly:
 - 1. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and no cladding system as directed by Architect.
 - a. See drawings for design and components.
 - b. Testing located on site performed with furring, flashing, and other components installed without cladding.
- C. Notify Manufacturer, Architect and Owner, in writing, minimum 14 days prior to conducting field-testing.
- D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.
- E. Field QA/QC Testing
 - 1. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and no cladding systems as directed by Architect.
 - a. See drawings for design and components.
 - b. Testing performed on site.
 - c. Testing performed after sealants have cured in accordance with manufacturer's written instructions.
 - d. Test location and volume to be determined at discretion of Architect.
 - 2. Test installed storefront for water penetration in accordance with ASTM E1105, and AAMA 503 uniform test pressure at 8 psf.
 - a. Field testing to be performed by an independent AAMA certified laboratory, and not part of design team.
 - b. Test locations and volume determined at discretion of Architect.
- F. Number of Tests: Minimum three (3) of each section of storefront and doors or as required to achieve compliance with manufacturer's published performance ratings.
 - 1. First Test: Take at initial installation.
 - 2. Second Test: Take at 50% completion.
 - 3. Third Test: Take at 80% completion.
 - 4. Test "Failure" is defined as any detectable (visibly or by water test paper) on interior face of IGU, frame, air sealant, or membranes.
 - 5. If any window fails, test 1 additional window of that series at Contractor's expense.
 - 6. Replace or repair windows that have failed field testing and retest until performance is satisfactory.
- G. Provide set-up, test chamber and items needed for testing.

1. Remove interior finishes to allow for observation during testing.
 2. Replace interior finishes after conclusion of testing.
- H. Test Chamber Requirements:
1. Locations: Where approved by Architect. Each test to include most typical details including interface with cladding types and typical penetration types.
 2. Chamber location to be selected to encompass as many typical details as possible, such as swing and sliding doors, operable vent, in-slab / fire vent hoods, fixed light, and tie-ins to adjacent systems.
 3. Construct per ASTM E1105 or as specified below.
 - a. Steel studs and plywood or Gypsum Board. Steel studs, top and bottom track, stud spacing and fastening to be same as exterior walls (3" studs at 16" o/c, min.). Gypsum Board should be installed on exterior side of test chamber.
 - b. Caulk or tape board joints and to adjacent concrete slabs and columns. Chamber must be sealed to window beyond edge of test section.
 - c. Access hatch (approx. 2'x3') to allow entrance and exit into chamber. Hatch must be removable and sealed for air leakage (loose drywall sheet with 3" overlap is acceptable).
 4. Fire caulk or fire tape board joints to adjacent concrete slabs and columns and/or exterior walls.
 - a. Chamber to be sealed to exterior beyond edge of test section.
 5. Contractor to supply water requirement to test chamber location:
 - a. 21 gallons per minute at 15 psi.
 - b. Below 10 stories, two separate 3/4 inch hoses attached individually to city supply from a 100 psi 1" branch is sufficient.
 - c. Connecting larger hose (greater than 1-1/2 inch) and splitting to (2) two 3/4 inch hoses at test may also be sufficient.
 - d. Length of hose exceeding 250 feet: Plastic piping to be used to minimize pressure loss due to higher friction of rubber hose.
 6. Contractor to supply electricity: 110V, 20 amp breaker, 1 dedicated circuit per floor.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Remove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Remove, dispose and recycle debris from project site per Section 01 74 19.

END OF SECTION

SECTION 08 53 13
VINYL WINDOWS AND DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vinyl-framed, factory-glazed windows.
- B. Doors
- C. Operating hardware.
- D. Insect screens.

1.02 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2022.
- B. AAMA 303 - Voluntary Specification for Rigid Polyvinyl Chloride (PVC) Exterior Profiles 2019.
- C. AAMA 307 - Voluntary Specification for Laminates Intended for Use on AAMA Certified Profiles; 2016.
- D. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products 2021.
- E. AAMA 701/702 - Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals 2011.
- F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.
- G. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- H. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- I. 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).
- J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023).
- K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- L. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).
- M. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015 (Reapproved 2023).
- N. ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation 2022.
- O. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact 2017.

- P. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- Q. NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.
- 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.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. See Section 01 30 00 - Administrative Requirements, for pre-installation meeting procedures.
- B. Preinstallation Meeting: Convene two weeks before starting work of this section.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, and installation requirements.
 - 1. Provide project specific details, including profiles and interfacing materials.
 - 2. Indicate coordinate with adjacent work.
 - 3. Shop drawings to include back angle gauge and size, back angle attachment to slab and back angle attachment to glazing system.
 - 4. Indicate continuity of air, water, thermal, and vapor barriers.
 - 5. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- D. Manufacturer's written installation instructions.
- E. Test Reports:
 - 1. Prior to submitting shop drawings or starting fabrication, submit test report(s).
 - 2. Furnish AAMA test reports from accredited independent testing laboratory certifying that identical or larger window units meet requirements specified.
 - a. Air Infiltration, Water penetration, and Structural Performance: AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
 - b. Thermal performance: NFRC 100 (Assembly U-value) and NFRC 200 (Assembly SHGC).
 - c. Insulated Glass Seal Integrity: IGCC certified.
- F. Label Verification Options - Thermal, Air, Water & Structural Performance:
 - 1. Label Placement: Provide permanent or mylar labels inside face at head, justified to far right and aligned with frame for QA/QC purposes.
 - 2. Provide one of the following three (3) Code options for thermal performance verification for largest and most complex unit.
 - a. Silver or gold permanent label and temporary labels with test report.
 - b. CPD Number from www.nfrc.org.
 - c. Certification letter from the Inspection Agency that assigns labels.
 - 3. Provide one of the following three (3) Code options for air/water/structural performance verification for largest and most complex unit.
 - a. AAMA/NAFS Label on window with test report.

- b. ASTM E330/E330M Structural Lab Test Report.
- c. ASTM E330/E330M Structural Lab Test Report with calculations for designated units smaller than tested units.
- 4. Provide NAFS Lab Test for QA/QC purposes (AAMA/WDMA/CSA101/I.S.2/A440) for water/air performance verification for the largest and most complex unit.
- 5. Performance submittals must be reviewed with positive disposition prior to fabrication for QA/QC purposes.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Installer's qualification statement.
- I. Warranty Documentation: Submit manufacturer sample warranty.

1.05 REGULATORY REQUIREMENTS

- A. Comply with Building Code for clear open area required to egress from sleeping areas.
- B. Operable Windows Outside of Residential Units Intended for Occupant Use:
 - 1. Per International Building Code (IBC) 1109.13 and ICC A117.1, at least one per space located in an accessible location per 305, within reach range per 308, and comply with operable per 309.
- C. Accessibly: Comply with ADA Standards and ICC A117.1 for doors, door components and door operation.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components 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 Qualifications: Company specializing in manufacturing products specified in this section, with not less than 12 years of documented experience.
- C. Installer Qualifications: Company specializing in performing of type specified and with at least three years documented experience and approved by manufacturer.

1.07 MOCK-UP

- A. See Section 01 43 39 - Free Standing Building Mockup, for full scale building mock-up and additional requirements.
- B. Mock-up Meeting: Convene two weeks before starting work of this section.
 - 1. Attendance Required:
 - a. Owner.
 - b. Architect.
 - c. Contractor.
 - d. Subcontractors
 - e. Installer foreman
 - f. Building envelope consultant
 - g. Testing agency
 - h. Manufacturer's technical representative.

- C. Locate where directed by Architect.
- D. Mock-up may not remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle windows and doors in accordance with manufacturer's written instructions.
- B. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
- C. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.09 FIELD CONDITIONS

- A. Maintain this minimum temperature during and after installation of sealants.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work (labor and materials) within a ten year period after Date of Substantial Completion.
 - 1. Upon completion of work, and as a condition of its acceptance, deliver to Architect two copies of written warranty agreeing to replace work which fails due to defective materials or installation.
- C. Provide twenty year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same.
- D. Provide ten year manufacturer warranty (labor and materials) against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking per AAMA 303 and AAMA 307.
- E. Failure due to defective materials or installation is deemed to include, but not to be limited to:
 - 1. Failures in operation of operating component or components.
 - 2. Water leakage or air infiltration in excess of specified standard.
 - 3. Deterioration of finish to an extent visible to unaided eye.
 - 4. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of Work of this Section or Work as a whole.
 - 5. Frame Warpage: 1/8 inch in 3 feet per AAMA 303.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Vinyl Windows:
 - 1. Basis of Design: VPI Quality Windows, Inc.; Product Endurance Series: www.vpiwindows.com.
 - a. Performance Requirements:
 - 1) Design Pressure: In accordance with ASCE 7, and as noted on structural drawings.

- 2) Assembly: To accommodate, without damage to components or deterioration of seals, movement between window and perimeter framing, deflection of lintel.
 - 3) Water Leakage: None, when measured in accordance with ASTM E331 at specified pressure difference of 10 lbs/sq. ft.
 - 4) Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapor retarder.
 - 5) Condensation Resistance Factor: CRF of 50, minimum, the lower value of the glass and frame window components and determined in accordance with AAMA 1503.
 - 6) Overall Thermal Transmittance (U-value): 0.26, maximum, including glazing, measured on window sizes required for this project.
 - 7) Thermal Movement: Design sections to permit movement caused by thermal expansion and contraction of plastic to suit glass, infill, and perimeter opening construction.
 - 8) Forced Entry Resistance (FER): Tested to comply with ASTM F588 requirements having at least Grade 10 performance for each required window assembly.
 - 9) Acoustic Performance: Minimum outdoor-indoor transmission class (OITC) rating of 27, and STC of 36, when tested in accordance with ASTM E90 and ASTM E1332.
 - (a) Rating at upgrades walls and windows: (OITC) rating of 28, and STC of 37.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DESCRIPTION

- A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with Integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
1. Configuration: As indicated on drawings.
 2. Frame Color Film: Color as selected.
 - a. Color integral with pulltrusion.
 - b. Color: Selected from manufacturers standard colors, interior white.
 3. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
 4. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
 5. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
 6. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.

2.03 COMPONENTS

- A. Glazing: See Section 08 80 00 Glazing.

- B. Material used within window assembly to be corrosion resistant, non-staining, non-bleeding and compatible with adjoining materials.
 - 1. Internal reinforcement shall be galvanized or shall be corrosion resistant.
 - 2. Ganged or Muller Windows Units: Factory or field ganged/mulled units not permitted.
- C. Frame Depth: 2-3/4 inches.
- D. Limit Stops: manufacturer standard, maximum opening 4 inches.
- E. Back Angle:
 - 1. Provide back angle as indicated on drawings, secure into window and substrate with fasteners.
 - 2. Size angle to develop lateral connection at sill.
 - 3. Material Type and Fasteners: Galvalume.
 - 4. Size: 18 gauge, minimum; As indicated on drawings.
- F. Drainage Mesh:
 - 1. Drainage mesh between sill nail flange and weather barrier.
 - 2. Width: Continuous at sill of window.
 - 3. Height: 3 inches.
 - 4. Quantity: Two (2) layers at sill.
 - 5. Fasteners: Stainless Steel.
 - 6. Detailing Compounds: Liquid membrane, 1 or 2 component sealants or mastics supplied by membrane manufacturer intended for detailing around penetrations and at lapped seams.
 - 7. Product: Frost King Weatherization Products, a Division of Thermwell Products Co., Inc.; Gutter Guard #VX620: www.frostking.com.
- G. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
 - 1. Hardware: Manufacturer's standard; quantity as required per screen.
 - 2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's 18 x 16 mesh.
 - 3. Frame Finish: Manufacturer's standard, color to match window frame and sash color.
- H. Weatherstripping:
 - 1. Full Vent Perimeter: Resilient PVC; permanently resilient, continuous at corners, profiled to maintain weather seal.
 - 2. Interer Sash Face: Foam, full perimeter.
 - 3. Vent Top Rail and Styles: Resilient PVC; permanently resilient, continuous at corners, profiled to maintain weather seal in accordance with AAMA 701/702.
 - 4. BottomVent Exterior Sill: Nylon pile; permanently resilient, continuous at corners, profiled to maintain weather seal in accordance with AAMA 701/702.
- I. Fasteners: Stainless steel or fasteners tested to 2000 hour salt spray.
- J. Flanges: Integral with frame, Attached not permitted.
- K. Accessories: Provide related flashings, anchorage and attachment devices as necessary for full assembly.

2.04 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush and hairline.
- C. Arrange fasteners to conceal from view.
- D. Prepare components with reinforcement for operating hardware.
- E. Reinforce mullions with internal galvanized steel members to maintain rigidity and meet structural loading requirements as indicated on structural drawings.
- F. Assemble insect screen frame, miter and reinforced frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.
- G. Double weatherstrip operable units.
- H. Dissimilar Metal Protection:
 - 1. Where in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- I. Frame Units:
 - 1. Factory assemble frame units to greatest extent possible.
 - 2. Rigidly secure non-movement joints.
 - 3. Seal joints watertight where required to prevent water entrance into system or interior of building.
 - 4. Corner Construction: Mitered Corners. Screw splines not allowed.
 - a. Provide keyed corners on fixed and operable lights.
 - 5. Provide each Frame Unit as a Master Framed Unit. Mullied mullions not allowed.

2.05 DOORS UNITS

- A. Swing Doors:
 - 1. Manufacturers:
 - a. Basis of Design: VPI Quality Windows, Inc.: www.vpiwindows.com.
 - 1) Swing Door: Envision Low Profile Threshold, two or three panels as indicated.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Performance Requirements:
 - a. Design Pressure: In accordance with ASCE 7 and as indicated on drawings.
 - b. Assembly: To accommodate, without damage to components or deterioration of seals, movement between door and perimeter framing, deflection of lintel.
 - 1) No mullied mullions or site assembled units permitted.
 - c. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapor retarder.
 - d. Water Leakage: None, when measured in accordance with ASTM E331 at specified pressure difference of 10.66 lbs/sq. ft.

- e. Overall Thermal Transmittance (U-value): 0.26, maximum, including glazing, measured on window sizes required for this project.
 - f. Thermal Movement: Design sections to permit movement caused by thermal expansion and contraction of plastic to suit glass, infill, and perimeter opening construction.
 - g. Forced Entry Resistance (FER): Tested to comply with ASTM F588 requirements having at least Grade 10 performance for each required door assembly.
3. Door Accessories:
- a. Stops: Anti-lift, preventing operable sash to be removed from the exterior.
 - b. Locks: Single-lever two point actuated four-point locking, catch at locking points, meeting forced entry resistance requirements of CAWM 301, lock key-actuated from exterior where applicable.
 - c. Weather-stripping: Double-row high-density polypropylene pile, with polypropylene fin, meeting AAMA 701/702.
 - d. Screens: Frame color matching window frame and sash interior color.
 - e. Style and sizes: As indicated on the drawings.

2.06 SWING DOORS

- A. Manufacturers:
- 1. Basis of Design: VPI Quality Windows, Inc.; Product Envision Low Profile Threshold: www.vpiwindows.com.
 - a. Performance Requirements
 - 1) Design Pressure: In accordance with ASCE 7 and Structural general notes.
 - 2) Assembly: To accommodate, without damage to components or deterioration of seals, movement between door and perimeter framing, deflection of lintel.
 - 3) Water Leakage: None, when measured in accordance with ASTM E331 at specified pressure difference of 6.00 lbs/sq. ft.
 - 4) Overall Thermal Transmittance (U-value): 0.25, maximum, including glazing, measured on door sizes required for this project.
 - 5) Thermal Movement: Design sections to permit movement caused by thermal expansion and contraction of plastic to suit glass, infill, and perimeter opening construction.
 - 6) Forced Entry Resistance (FER): Tested to comply with ASTM F588 requirements having at least Grade 10 performance for each required door assembly.
 - 7) Acoustic Performance: Minimum outdoor-indoor transmission class (OITC) rating of 24 and STC of 31, when tested in accordance with ASTM E90 and ASTM E1332.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Provide following:
- 1. Hardware: Manufacturer's standard multi-point locking hardware, subject to Architect/Owner approval.
 - a. Threshold: Low Profile.
 - 2. Weather-stripping: Manufacturer's standard required to meet performance requirements.
 - 3. Style and sizes: As indicated on drawings.
 - 4. Finish: Match windows.

2.07 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials: As specified in Section 08 80 00.

2.08 SEALANT MATERIALS

- A. Interior Sealant Used Within System (Not Used for Glazing): Air-infiltration sealant as specified in Section 07 92 00.

2.09 HARDWARE

- A. Sash lock: Lever handle and keeper with cam lock, provide at least one for each operating sash.
- B. Casement/Awning Sash: Steel rotary arm sash operating mechanism with fold-down handle and two bar adjustable hinges and keepers fitted to projecting sash arms with limit stops.
- C. Projecting Sash Lock: Single lever, multi-point, locking mechanism.
- D. Tilt-and-Turn Sash: Multi-point locking hardware allowing sash to swing inward in one handle position, and for top to tilt inward in second position. Center position locks sash.
- E. Finish of Exposed Hardware: Baked enamel, match interior sash and frame color.
- F. Fabricate framing, mullions and sash members with welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.
 - 1. Remove shims once window is fastened in place.
- G. Factory glaze window units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify wall openings and adjoining water-resistive barrier seal materials are ready to receive this work.
- B. Examine openings, substrate, structural support, anchorage, dimensions, tolerances, and method of attachment with other work with installer present for manufacture's compliance requirements.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected or accommodations acceptable to Architect have been made.

3.02 INSTALLATION

- A. Install window units and doors units in accordance with manufacturers written installation instructions, applicable building codes and as indicated on drawings.
- B. Set window on 3/8 inch minimum intermittent shims for subsill drainage under window.
 - 1. Fasten sill through metal back angle at back of window. DO NOT FASTEN THROUGH SILL NAIL FIN.
 - 2. Set shims per manufacturers written instructions for height, minimum and maximum.
- C. Attach window frame to perimeter opening to accommodate construction tolerances and other irregularities as necessary.
 - 1. Connection at head to allow for opening shrinkage and deflection.

2. Adhere drainage mesh with vertical strips of adhesive every 2 inches.
- D. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.
- E. Install operating hardware.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
 1. Notifications:
 - a. Notify attendees of scheduled field testing a minimum of 14 days in advance of conducting field testing and notify attendances 3 days in advance if testing is canceled.
 2. Attendance Required:
 - a. Owner.
 - b. Architect.
 - c. Contractor.
 - d. Subcontractors
 - e. Installer foreman
 - f. Building envelope consultant
 - g. Testing agency
 - h. Manufacturer's technical representative.
- B. Testing Exterior Assembly:
 1. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and no cladding system as directed by Architect.
 - a. See drawings for design and components.
 - b. Testing located on site performed with furring, flashing, and other components installed without cladding or interior finishes.
 - c. Testing shall be conducting after sealants have cured in accordance with manufacturers written instructions.
- C. Test installed windows and doors for compliance with performance requirements for water penetration, in accordance with AAMA 502 (cyclic) and ASTM E1105 cyclic pressure .
 1. Number of Tests: Minimum six (6) windows and three (3) doors or as required to achieve compliance with manufacturer's published performance ratings.
 - a. First Test Day: Take at initial installation.
 - b. Second Test Day: Take at 20% completion.
 - c. Third Test Day: Take at 40% completion.
 - d. Fourth Test Day: Take at 50% completion.
 - e. Fifth Test Day: Take at 70% completion.
 - f. Sixth Test Day: Take at 90% completion.

2. If any window or door unit fails, test one (1) additional window of that series at Contractor's expense.
 3. Replace or repair windows that have failed field testing and retest until performance is satisfactory.
- D. On-site tests for water infiltration will be performed as described herein.
1. Correct deficiencies in units, which fail to meet specified requirements, and units having similar deficiencies. Defective units to be retested.
 2. Test window and door, including perimeter joint and interface with adjacent building construction.
- E. Field QA/QC Testing:
1. Cyclical pressure testing to be performed to FOUR cycles of 5 minutes each as described in referenced standard, AAMA 502.
 2. Door Test "Failure" is defined as any detectable (visibly or by water test paper) on interior face of door, frame, air sealant, or membranes that not have a provision for drainage to exterior.
 3. Window Test "Failure" is defined as any detectable (visibly or by water test paper) on interior face of IGU, frame, air sealant, or membranes.
- F. Field Test Parameters
1. Testing is to be conducted on interior seals, typically window to wall interface.
 2. Pressure differential for water penetration testing:
 - a. Window systems: 6.0 psf. No further reduction in lab design pressures allowed during field testing.
 - b. Swing and sliding doors: 4.0 psf
 3. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.
 - a. Windows: Maximum allowable rate of air leakage is: 0.06 cfm/sq ft.
 - b. Swing Doors: Maximum allowable rate of air leakage is: 0.01 cfm/sq ft.
- G. Mockup test requirements:
1. Chamber locations to be selected to encompass as many typical details as possible, such as swing and sliding doors, operable vent, in-slab / fire vent hoods, fixed light, and tie-ins to adjacent systems. Testing Agency will be responsible to build test chamber and provide services below:
 2. Field Testing Requirements:
 - a. Water: 21 gal (76 liters) per minute at 15 psi.
 - b. Below 10 stories, two separate 3/4 inch hoses attached individually to city supply from a 100 psi 1" branch is sufficient.
 - c. Connecting larger hose (>1-1/2") and splitting to 2 X 3/4" hoses at test is acceptable.
 - d. Length of hose exceeding 250 feet: Provide plastic piping to minimize pressure loss due to higher friction of rubber hose.
 - e. Electricity: 110V, 20 amp breaker, 1 dedicated circuit per floor.
 3. Test Chamber:
 - a. Construct per ASTM E1105 or as specified below.
 - 1) Wood studs and plywood. Wood studs, top and bottom track, stud spacing and fastening to be same as exterior walls (3" studs at 16" o/c, min.).

- 2) Caulk or tape board joints and to adjacent concrete slabs and columns. Chamber must be sealed to window beyond edge of test section.
- 3) Access hatch (approx. 2'x3') to allow entrance and exit into chamber. Hatch must be removable and sealed for air leakage (loose drywall sheet with 3" overlap is acceptable).

3.05 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

- A. Labels:
 1. Leave temporary labels in place, intact and legible, until reviewed and approved by Architect and Owner, then remove.
 2. Permanent AAMA/NFRC labels to remain.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- C. Remove, dispose and recycle debris from project site per Section 01 74 19.

END OF SECTION

**SECTION 08 54 13
FIBERGLASS WINDOWS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass windows with painted exterior and interior finish of the following type(s):
 - 1. Awning windows.
 - 2. Picture windows.
- B. Factory fabricated fiberglass windows with fixed and operating sash.
- C. Glazed by factory; including infill panels.
- D. Operating hardware.
- E. Insect screens.

1.02 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2022.
- B. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products 2021.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference 2000 (Reapproved 2016).
- E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015 (Reapproved 2023).
- G. ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation 2022.
- H. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact 2017.
- I. FS L-S-125 - Screening, Insect, Nonmetallic 1972b, with Notice (1987).
- J. NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week week before starting work of this section.

1.04 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Delegated Design Scope:

1. Back angle thickness, attachment to framing and attachment to window.
- C. Product Data: Provide component dimensions, anchors, fasteners, glass, internal drainage details, and finish product information.
- D. Engineered Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements, design pressure requirements. Provide Engineer's stamp on drawings.
- E. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 1. Evidence of AAMA Certification.
 2. Evidence of WDMA Certification.
 3. Evidence of CSA Certification.
 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- F. Test Reports:
 1. Prior to submitting shop drawings or starting fabrication, submit test report(s).
- G. Label Verification Options - Thermal, Air, Water & Structural Performance:
 1. Label Placement: Provide permanent or mylar labels inside face at head, justified to far right and aligned with frame for QA/QC purposes.
 2. Provide one of the following three (3) Code options for thermal performance verification for largest and most complex unit.
 - a. Silver or gold permanent label and temporary labels with test report.
 - b. CPD Number from www.nfrc.org.
 - c. Certification letter from the Inspection Agency that assigns labels.
 3. Provide NAFS Lab Test for QA/QC purposes (AAMA/WDMA/CSA101/I.S.2/A440) for water/air performance verification for the largest and most complex unit.
 4. Performance submittals must be reviewed with positive disposition prior to fabrication for QA/QC purposes.
- H. Warranty Documentation: Submit manufacturer standard warranty.

1.05 DOCUMENTATION FOR ON-SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for On-Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for on-site information:
 1. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations, stamped by an engineer licensed in the State where project is located post approved shop drawings.
 2. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
 3. Installer's qualification statement: Provide letter from manufacture, indicating installer and company are approved to install storefront system for this application.
 4. Test Reports:

- a. Provide one of the following three (3) Code options for air/water/structural performance verification for largest and most complex unit.
 - 1) AAMA/NAFS Label on window with test report.
 - 2) ASTM E330/E330M Structural Lab Test Report.
 - 3) Laboratory Test Report.
 - 4) ASTM E330/E330M Structural Lab Test Report with calculations for designated units smaller than tested units.
5. Inspection reports.
6. Manufacturer's written instructions.
7. Coordination Drawings.
8. Other types indicated.

1.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Submittals for On-Site information
 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during delivery, storage and handling.
- B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturers standard express limited warranty on fiberglass frame components for a period of 20 years for workmanship and materials.
- C. Provide manufacturers standard express limited warranty on integral hardware for a period of 10 years for workmanship and materials.
- D. Provide manufacturers standard express warranty for the insulated glass units to cover premature hermetic seal failure (condensation between the lites at normal service temperatures) appearing within a period of 10 years from the date of substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Cascadia Windows and Doors; Product - Universal Series: www.cascadiawindows.com.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WINDOW UNITS

- A. Fiberglass Windows: Hollow, tubular, multi-layer fiber reinforced material; factory fabricated pultruded with graphite impregnated PST insulation; with vision glass, related flashings, anchorage and attachment devices.
 - 1. Configuration: As indicated on drawings.
 - 2. Fiberglass Glass Content: 55% minimum.
 - 3. Finish: Manufacturers standard 2-part water-born acrylic system.
 - a. Dry film thickness: 1 mil, minimum.
 - b. Gloss rating: 25-40.
 - 4. Color: Black.
 - 5. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 6. System Pressure Equalized Drainage: Drain to the exterior by means of concealed weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

2.03 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type.
 - 1. Performance Grade (PG) and Class of all windows and doors shall be:
 - a. For fixed windows, CW-95 or higher.
 - b. For operable window (inswing or outswing), CW-45 or higher.
- B. Design Pressure (DP): In accordance with ASCE 7 and as indicated on Structural drawings.
- C. Deflection: Limit member deflection to 1/175 of the longer dimension with full recovery of glazing materials.
- D. Overall Thermal Transmittance (U-value): 0.25, maximum, including glazing, measured on window sizes required for this project.
- E. Water Leakage: No detectable water leakage on interior face of IGU or frame when tested in accordance with ASTM E547 at differential pressure of 15.0 psf.
- F. Air Leakage:
 - 1. Air infiltration and exfiltration rates at a static air pressure differential of 1.6 psf (75 Pa) when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440-11 and ASTM E283 to be not more than:
 - a. Fixed Windows (interior or exterior glazed): 0.00 cfm/ft² (0.00 L/s.m²).
 - b. Outward opening awning-type windows: 0.00 cfm/ft² (0.01 L/s.m²).

- G. Acoustic Performance: Minimum outdoor-indoor transmission class (OITC) rating of 28, when tested in accordance with ASTM E90 and ASTM E1332.
 - 1. STC Rating: 34 fixed and 35 Operable.
- H. Forced Entry Resistance: Comply with ASTM F588 for measured performance of Grade 20 in accordance with requirements.

2.04 COMPONENTS

- A. Material used within window assembly to be corrosion resistant, non-staining, non-bleeding and compatible with adjoining materials.
 - 1. Internal reinforcement shall be fiberglass, aluminum, galvanized or shall be corrosion resistant.
 - 2. Ganged or Muller Windows Units: Factory ganged/mulled units only. field ganged units not permitted.
- B. Frames: 4 1/2 inch deep profile; applied glass stops.
- C. Insect Screens: FS L-S-125 woven plastic mesh; 14/18 mesh size.
 - 1. Color: Match frame color.
 - 2. Fixed with operable hatch at outswing operable windows.
- D. Drainage Mesh:
 - 1. Drainage mesh between sill nail flange and waterproofing.
 - 2. Width: Continuous at sill of window.
 - 3. Height: 3 inches.
 - 4. Product: Frost King Weatherization Products, a Division of Thermwell Products Co., Inc.; Gutter Guard #VX620: www.frostking.com.
- E. Back Angle:
 - 1. Provide back angle as indicated on drawings, secure into window and substrate with fasteners.
 - 2. Size angle to develop lateral connection at sill.
 - 3. Material Type and Fasteners: Aluminum or Galvalume steel.
 - 4. Size: 18 gauge, 1-1/2 inch x 1-1/2 inch.
- F. Fasteners: 300 series stainless steel, 400 series stainless steel, or Leland Industries DT2000 coated of sufficient size and quantity to perform their intended function.
- G. Flanges: Integral with frame all four sides, Attached not permitted.
 - 1. Option: Strap anchors at head and jambs.
 - 2. Flashing attachment at sill.

2.05 SEALANT MATERIALS

- A. Interior Sealant Used Within System (Not Used for Glazing): Air-infiltration sealant as specified in Section 07 92 00.

2.06 GLASS AND GLAZING MATERIALS

- A. Glazing: See Section 08 80 00 -Glazing.

2.07 WINDOW TYPES

- A. Awning - 300 Series
 - 1. Sash: Minimum 2-3/8 inch (60.3 mm) deep, multi-chambered fiberglass pultrusions.
 - 2. Hardware:
 - a. Dual lever locking mechanism.
 - b. Two bar stainless steel hinge.
 - 3. Weatherstripping: Vinyl compression bulb seal.
- B. Picture - 400 Series
 - 1. Sightlines: Equal to operating windows.

2.08 HARDWARE

- A. Outswing Casement and Awning Sash: RotoSil nano corrosion resistant finish on hinge components and stainless steel multi-point lock back, stainless steel locking keepers, and stainless steel rotary crank operator with folding handle.
- B. Window Limit Stops: Provide operable window sash hardware that limits openings to only allow passage of 4 inch diameter rigid sphere or less, and are easily releasable to fully open without use of keys, tools, or special knowledge.

2.09 FINISH

- A. Frame and Sash: Hydro Tuff two-component waterborne polyurethane, meeting the requirements of AAMA-625.
 - 1. Exterior: As selected from manufacturers standard color range.
 - 2. Interior: As selected from manufacturers standard color range.
 - 3. Color: _____.
- B. Screen Frame Color:
 - 1. Exterior Mounted Screens: Match frame to exterior window frame and sash color.
 - 2. Interior Mounted Screens: Bronze.

2.10 FABRICATION

- A. Fabricate framing, mullions and sash members with corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.
- B. Form sills and stools in one piece. Slope sills for wash.
- C. Form snap-in glass stops, closure molds, weather stops, and flashings for tight fit into window frame section.
- D. Form weather stop flange to perimeter of unit.
- E. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- F. Arrange fasteners to be concealed from view.
- G. Provide continuous heal sealant bead at each glass lite for vapor and air barrier continuity.
- H. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

- I. Assemble insect screen frame, miter and reinforced frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.
- J. Double weatherstrip operable units.
- K. Dissimilar Metal Protection:
 - 1. Where in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- L. Frame Units:
 - 1. Factory assemble frame units to greatest extent possible.
 - 2. Rigidly secure non-movement joints.
 - 3. Seal joints watertight where required to prevent water entrance into system or interior of building.
 - 4. Assemble components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within system to exterior.
 - 5. Corner Construction: Mitered Corners.
 - a. Provide keyed corners on fixed and operable lights.
 - 6. Provide each Frame Unit as a Master Framed Unit. Field mulled mullions not allowed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install windows in accordance with manufacturer's written instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Strap Anchors: Set in bed of sealant and seal over anchors.
- D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- E. Set sill members and sill flashing in continuous bead of sealant at back angle.
- F. 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.
- G. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- H. Install operating hardware.
- I. Install perimeter sealant and backing materials in accordance with Section 07 92 00.

3.02 TOLERANCES

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
- B. Exterior Assembly:
 - 1. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and no cladding system as directed by Architect.
 - a. See drawings for design and components.
 - b. Testing located on site performed with furring, flashing, and other components installed without cladding.
- C. Glazing Inspection: Provide independent inspection by Window Glazing Engineer prior to following testing.
 - 1. First Installation.
 - 2. 50% completion.
 - 3. 80% completion.
- D. Test installed windows and doors for compliance with performance requirements for water penetration, in accordance with AAMA 502 and ASTM E1105 cyclic pressure .
 - 1. Number of Tests: Minimum four (4) of each type of windows and doors or as required to achieve compliance with manufacturer's published performance ratings.
 - a. First Test Day: Building mockup.
 - b. Second Test Day: Take at initial installation.
 - c. Third Test Day: Take at 50% completion.
 - d. Fourth Test Day: Take at 80% completion.
 - 2. If any window fails, test 1 additional window of that series at Contractor's expense.
 - 3. Replace or repair windows that have failed field testing and retest until performance is satisfactory.
- E. On-site tests for water infiltration will be performed as described herein.
 - 1. Correct deficiencies in units, which fail to meet specified requirements, and units having similar deficiencies. Defective units to be retested.
 - 2. Testing located on site performed with furring, flashing, and other components installed without cladding.
 - 3. Test window and door, including perimeter joint and interface with adjacent building construction.
 - 4. Sealants to be fully cured prior to any test.
- F. Field QA/QC Testing:
 - 1. Windows shall have no water infiltration at a cyclic static air pressure difference at 12 psf (575 Pa) when tested in accordance with AAMA 101 and ASTM E1105.
 - 2. Cyclical pressure testing to be performed to FOUR cycles of 5 minutes each as described in referenced standard, AAMA 502.
 - 3. Test "Failure" is defined as any detectable (visibly or by water test paper) on interior face of IGU, frame, air sealant, or membranes.
- G. Field Test Parameters
 - 1. Testing is to be conducted on interior seals, typically window to wall interface.
 - 2. Pressure differential for water penetration testing:

- a. Window systems: ____ psf.
 - b. No further reduction in lab design pressures allowed during field testing.
- H. Mockup test requirements:
1. Provide 10 working day notification of window testing and notify the following:
 - a. Manufacturer
 - b. Architect
 - c. Subcontractors
 - d. Building Envelope consultants
 2. Chamber locations to be selected to encompass as many typical details as possible, such as swing and sliding doors, operable vent, in-slab / fire vent hoods, fixed light, and tie-ins to adjacent systems. Contractor will be responsible to build test chamber and provide services below:
 3. Field Testing Requirements:
 - a. Water: 21 gal (76 litres) per minute at 15 psi.
 - b. Below 10 stories, two separate 3/4 inch hoses attached individually to city supply from a 100 psi 1" branch is sufficient.
 - c. Connecting larger hose (>1-1/2") and splitting to 2 X 3/4" hoses at test is acceptable.
 - d. Length of hose exceeding 250 feet: Provide plastic piping to minimize pressure loss due to higher friction of rubber hose.
 - e. Electricity: 110V, 20 amp breaker, 1 dedicated circuit per floor.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.
- B. Labels:
 1. Leave temporary labels in place, intact and legible, until reviewed and approved by Architect and Owner.
 2. Permanent NFRC labels to remain.
- C. Remove protective material from pre-finished surfaces.
- D. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Automatic operators.
 - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 01 Section "Closeout Procedures"
 - 2. Division 08 Section "Operations and Maintenance".
 - 3. Division 08 Section "Hollow Metal Doors and Frames".
 - 4. Division 08 Section "Interior Aluminum Doors and Frames".
 - 5. Division 08 Section "Flush Wood Doors".
 - 6. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 7. Division 08 Section "Automatic Door Operators".
 - 8. Division 28 Section "Access Control Hardware Devices".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.

7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
1. ANSI/BHMA Certified Product Standards - A156 Series.
 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 3. ANSI/UL 294 - Access Control System Units.
 4. UL 305 - Panic Hardware.
 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data,

Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Building Information Modeling (BIM) Qualifications: BIM software tools and processes are used to produce and support data integration of product and technical information used in specifications, submittals, project reviews, decision support, and quality assurance during all phases of Project design, construction, and facility management. Door and hardware schedules and the associated product data parameters are to be derived, updated, and fully integrated with the coordinated Building Information Modeling as required under Division 01.
- F. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through the Norton Preferred Installer (NPI) program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.
- G. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- H. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- K. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.
- D. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 3. Five years for exit hardware.
 - 4. Twenty five years for manual overhead door closer bodies.
 - 5. Five years for motorized electric latch retraction exit devices.
 - 6. Two years for electromechanical door hardware, unless noted otherwise.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 5. Manufacturers:
 - a. Hager Companies (HA) - BB Series, 5 knuckle.
 - b. Ives (IV) - 5BB Series, 5 knuckle.
 - c. McKinney (MK) - TA/T4A Series, 5 knuckle.

- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
1. Manufacturers:
 - a. Hager Companies (HA).
 - b. Ives (IV).
 - c. Pemko (PE).
- C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.
1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
 2. Cascading: Provide a bi-parting or single direction telescoping system as required with a minimum 200 lb. per door capacity.
 3. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.
 4. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
 5. Manufacturers:
 - a. Hager Companies (HA).
 - b. Johnson Hardware (JO).
 - c. Pemko (PE).

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
 - a. Hager Companies (HA) - ETW-QC (# wires) Option.
 - b. Ives (IV) - Connect.
 - c. McKinney (MK) - QC (# wires) Option.
- B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug

directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
 - a. Pemko (PE) - EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
 - c. Von Duprin (VD) - EPT-10 Series.

- C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:
 - a. Hager Companies (HA) - Quick Connect.
 - b. McKinney (MK) - QC-C Series.
 - c. Von Duprin (VD) - Connect.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
 - c. Trimco (TC).

- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
1. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
 - c. Trimco (TC).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 5. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
 - c. Trimco (TC).
- D. Locking Pull System: Post-mount style door pulls with integrated deadbolt locking system in type and design as specified in the Hardware Sets. Pulls available in multiple head, floor, or combination locking options, with outside keyed rim cylinder operation and inside turn piece activation. Mounting applications for aluminum, glass, steel and wood doors, with customized sizing and configuration options. Locking pulls shall be provided with a 10" clearance from the finished floor on the cylinder side to accommodate wheelchair accessibility.
1. Manufacturers:
 - a. Rockwood (RO) - LP Series.

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
1. Manufacturers:

- a. dormakaba Best (BE).
 - b. Schlage (SC).
 - c. Medeco (MC).
- C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Match Facility Standard.
- D. Removable Cores: Provide removable cores as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. New System: Key locks to a new key system as directed by the Owner.
- F. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- G. Construction Keying: Provide construction master keyed cylinders.
- H. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:

- a. Lund Equipment (LU).
- b. Telkee (TK).

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 1. Mortise locks to be certified Security Grade 1.
 2. Where specified, provide status indicators with highly reflective color and wording for “locked/unlocked” or “vacant/occupied” with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1” x 0.6” with a curved design allowing a 180 degree viewing angle with protective covering to prevent tampering.
 3. Manufacturers:
 - a. dormakaba Best (BE) - 45H Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Yale Commercial(YA) - 8800FL Series.
- B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
 1. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).
 2. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 3. Locks are to be non-handed and fully field reversible.
 4. Manufacturers:
 - a. dormakaba Best (BE) - 9K Series.
 - b. Sargent Manufacturing (SA) - 10X Line.
 - c. Yale Commercial(YA) 5400LN Series.
- C. Residential Tubular Locking Devices: Standard ANSI A156.2, Series 4000, Grade 2.
 1. Tubular locksets, deadbolts, and handlesets designed to fit ANSI standard door preps.
 2. Locks are to be non-handed and have adjustable backset.
 3. Manufacturers:

- a. Yale Residential (YR) - YH Series.
- b. Taymor.

2.8 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed, subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below and in the hardware sets.
 1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 3. Manufacturers:
 - a. dormakaba Best (BE) - 45HW EL/EU Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Yale Commercial(YA) - 8800FL Series.
- B. Electromechanical Cylindrical Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical cylindrical locksets, electrified locksets to be of type and design as specified below.
 1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 2. Manufacturers:
 - a. dormakaba Best (BE) - 93K EL/EU Series.
 - b. Sargent Manufacturing (SA) - 10G70/71 Series.
 - c. Yale Commercial(YA) - 5400LN Series.

2.9 AUXILIARY LOCKS

- A. Mortise Deadlocks, Large Case: ANSI/BHMA A156.13 Grade 1 Certified Products Directory (CPD) listed large case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. One piece stainless steel bolts with a 1" throw. Deadlocks to be products of the same source manufacturer and keyway as other locksets.
 1. Manufacturers:

- a. dormakaba Best (BE) - 47H Series.
- b. Sargent Manufacturing (SA) - 8200 Series.
- c. Yale Commercial(YA) - 8800 Series.

B. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8" diameter bolts.

1. Manufacturers:

- a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the

proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Sargent Manufacturing (SA) - 80 Series.
 - b. dormakaba Best (PR) - Apex 2000 Series.
 - c. Yale (YA) - 7000 Series.

2.12 ELECTROMECHANICAL EXIT DEVICES

- A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.
1. Energy Efficient Design: Provide devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 2. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.
 3. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
 4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Yale (YA) - 7000 Series.

2.13 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:

- a. Norton Rixson (NO) - Unitrol Series.
- b. Yale Commercial(YA) - Unitrol Series.

- C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:

- a. LCN Closers (LC) - 1450 Series.
- b. Norton Rixson (NO) - 8500 Series.
- c. Sargent Manufacturing (SA) - 1431 Series.

2.14 SURFACE MOUNTED CLOSER HOLDERS

- A. Multi-Point Closer Holders: Multi-point closer holder designed to hold open fire or smoke rated doors until interruption of signal from fire alarm, smoke detector or remote release switch. Pull side, push side, or double egress mounting applications available with non-handed track and closer body and dual voltage input (24V/120V). Voltage to be 24VDC unless otherwise specified. Multi position hold-open positions range from 10 to 170 degrees, with trim permitting. Provide optional swing free arm application (pull side) where specified. Auxiliary door stops are required at hold open point.

1. Manufacturers:

- a. LCN Door Closers (LC) - 4040SEL Series
- b. Norton Rixson (NO) - 7200 Series.
- c. Norton Rixson (RF) - Smok-Chek V Series.

2.15 ARCHITECTURAL TRIM

- A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Hager Companies (HA).
 - b. Rockwood (RO).
 - c. Trimco (TC).

2.16 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Hager Companies (HA).
 - b. Rockwood (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:

- a. Norton Rixson (RF).
- b. Rockwood (RO).

2.17 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. Pemko (PE).
 2. Reese Enterprises, Inc. (RE).

2.18 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect based on drawings dated 07/18/2022. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

- 1. Quantities listed are for each pair of doors, or for each single door.
- 2. The supplier is responsible for handing and sizing all products.
- 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
- 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

- B. Manufacturer's Abbreviations:

- 1. MK - McKinney
- 2. OT - Other
- 3. PE - Pemko
- 4. SU - Securitron
- 5. RO - Rockwood
- 6. AD - Adams Rite
- 7. YR - Yale Residential
- 8. YA - Yale
- 9. SC - Schlage
- 10. RF - Rixson
- 11. NO - Norton

Hardware Sets

Set: 1.0

Doors: 3-132A

2	Continuous Hinge	BSPFM__HD1 (SLF @ alum storefront)		PE
1	Inactive Leaf Header Bolt	4085-__-IB	603	AD
1	Threshold Bolt	4015-18-IB	603	AD
1	Mortise Deadlock	MS1850S 1	335	AD
1	Mortise Cylinder	LFIC to match std x req'd cam	Black	SC
1	Thumbturn Cylinder	4066-01	130	AD
2	Door Pull	BF159 Mtg-Type 6HD	BSP	RO
2	Push Bar	47-PB Mtg-Type 6	BSP	RO
2	Surface Closer, Stop Arm	CPS8501	BSP	NO
1	Threshold	Per detail x FHSL14		PE
1	Perimeter Gasketing	By Door Manufacturer		OT
2	Ext. Sweep	3452BSPNB		PE
1	Cylinder Guard	MS4043-00	130	AD
1	Status Indicator	4089	130	AD

Set: 2.0

Doors: 5-100A, 5-100B

1	Continuous Hinge	BSPFM__HD1 (SLF @ alum storefront)		PE
1	Mortise Deadlock	MS1850S 1	335	AD
1	Mortise Cylinder	LFIC to match std x req'd cam	Black	SC
1	Thumbturn Cylinder	4066-01	130	AD
1	Door Pull	BF159 Mtg-Type 6HD	BSP	RO
1	Push Bar	47-PB Mtg-Type 6	BSP	RO
1	Surface Closer, Stop Arm	CPS8501	BSP	NO
1	Threshold	Per detail x FHSL14		PE
1	Perimeter	By Door Manufacturer		OT

Gasketing			
1 Ext. Sweep	3452BSPNB		PE
1 Cylinder Guard	MS4043-00	130	AD
1 Status Indicator	4089	130	AD

Set: 3.0

Doors: 2-118B

1 Continuous Hinge	BSPFM__HD1 (SLF @ alum storefront)		PE
1 Dormitory Lock	AUR 8822FL	BSP	YA
1 Mortise Cylinder	LFIC to match std x req'd cam	Black	SC
1 Surface Closer, Hvy Duty Arm	PR8501	BSP	NO
1 Door Stop	466-RKW or OH stop where floor stop presents tripping hazard	Black	RO
1 Threshold	Per detail x FHSL14		PE
1 Perimeter Gasketing	By Door Manufacturer		OT
1 Ext. Sweep	3452BSPNB		PE

Set: 4.0

Doors: 3-140B

1 Continuous Hinge	BSPFM__HD1 (SLF @ alum storefront)		PE
1 Rim Exit Device, Exit Only	7100 EO	BSP	YA
1 Surface Closer, Hvy Duty Arm	PR8501	BSP	NO
1 Door Stop	466-RKW or OH stop where floor stop presents tripping hazard	Black	RO
1 Threshold	Per detail x FHSL14		PE
1 Perimeter Gasketing	By Door Manufacturer		OT
1 Ext. Sweep	3452BSPNB		PE

Set: 5.0

Doors: 2-100, 2-130A

1	Continuous Hinge	BSPFM__HD1 (SLF @ alum storefront)		PE	
1	Continuous Hinge	BSPFM__HD1 PT (SLF @ alum storefront)		PE	
1	Electric Power Transfer	EL-CEPT	BSP	SU	⚡
1	Concealed Vert Rod Exit, Exit Only	7220 EO	BSP	YA	
1	Concealed Vert Rod Exit, Storeroom	7220 B MELR 503F	BSP	YA	⚡
2	Door Pull	BF159 Mtg-Type 6HD	BSP	RO	
1	Surface Closer, Hvy Duty Arm	PR8501	BSP	NO	
1	Automatic Opener	6300 Series	BSP	NO	⚡
2	Door Stop	466-RKW or OH stop where floor stop presents tripping hazard	Black	RO	
1	Threshold	Per detail x FHSL14		PE	
1	Perimeter Gasketing	By Door Manufacturer		OT	
2	Ext. Sweep	3452BSPNB		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Card Reader and Power	By Div 28		OT	
2	Wave Actuator	700		NO	⚡

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Tie auto operator actuator at entrance side to card reader. Key override provided. Free egress at all times.

Set: 6.0

Doors: 2-100B, 2-143A, 2-ST-1.1A, 3-100A, 3-100E, 3-153, 3-156, 4-101, 4-107B

1	Continuous Hinge	BSPFM__HD1 PT (SLF @ alum storefront)		PE	
1	Electric Power Transfer	EL-CEPT	BSP	SU	⚡
1	Rim Exit Device, Nightlatch	7100 B MELR 121NL	BSP	YA	⚡

1 Door Pull	BF159 Mtg-Type 6HD	BSP	RO
1 Surface Closer, Hvy Duty Arm	PR8501	BSP	NO
1 Door Stop	466-RKW or OH stop where floor stop presents tripping hazard	Black	RO
1 Threshold	Per detail x FHSL14		PE
1 Perimeter Gasketing	By Door Manufacturer		OT
1 Ext. Sweep	3452BSPNB		PE
1 Frame Harness	QC-C1500		MK ⚡
1 Door Harness	QC-C__ (as required)		MK ⚡
1 Card Reader and Power	By Div 28		OT

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Key override provided. Free egress at all times.

Set: 7.0

Doors: 1-100.1-C, 1-100.2C, 1-100A, 1-136, 3-135, 3-140A

1 Continuous Hinge	BSPFM__HD1 PT (SLF @ alum storefront)		PE
1 Electric Power Transfer	EL-CEPT	BSP	SU ⚡
1 Rim Exit Device, Nightlatch	7100 B MELR 121NL	BSP	YA ⚡
1 Door Pull	BF159 Mtg-Type 6HD	BSP	RO
1 Automatic Opener	6300 Series	BSP	NO ⚡
1 Door Stop	466-RKW or OH stop where floor stop presents tripping hazard	Black	RO
1 Threshold	Per detail x FHSL14		PE
1 Perimeter Gasketing	By Door Manufacturer		OT
1 Ext. Sweep	3452BSPNB		PE
1 Frame Harness	QC-C1500		MK ⚡
1 Door Harness	QC-C__ (as required)		MK ⚡
1 Card Reader and Power	By Div 28		OT
2 Wave Actuator	700		NO ⚡

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Tie auto operator actuator at entrance side to card reader. Key override provided. Free egress at all times.

Set: 8.0

Doors: 1-131

1	Continuous Hinge	BSPFM__HD1 PT (SLF @ alum storefront)		PE	
1	Electric Power Transfer	EL-CEPT	BSP	SU	⚡
1	Rim Exit Device, Nightlatch	7100 B MELR 121NL	BSP	YA	⚡
1	Door Pull	BF159 Mtg-Type 6HD	BSP	RO	
1	Surface Closer, Hvy Duty Arm	PR8501	BSP	NO	
1	Kick Plate	K1050 10"H BEV CSK	BSP	RO	
1	Door Stop	466-RKW or OH stop where floor stop presents tripping hazard	Black	RO	
1	Threshold	Per detail x FHSL14		PE	
1	Gasketing	S88BL Width x Height		PE	
1	Ext. Sweep	3452BSPNB		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Card Reader and Power	By Div 28		OT	

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Key override provided. Free egress at all times.

Set: 9.0

Doors: 1-130, 1-139, 1-148, 2-139, 3-136, 3-158

1	Continuous Hinge	BSPFM__HD1 (SLF @ alum storefront)		PE	
1	Rim Exit Device, Nightlatch	7100 B MELR 121NL	BSP	YA	⚡
1	Vandal Resistant Trim	VRT14	BSP	RO	
1	Surface Closer,	PR8501	BSP	NO	

Hvy Duty Arm			
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Door Stop	466-RKW or OH stop where floor stop presents tripping hazard	Black	RO
1 Threshold	Per detail x FHSL14		PE
1 Rain Guard	346C x full frame width, omit @ overhangs		PE
1 Gasketing	S88BL Width x Height		PE
1 Ext. Sweep	3452BSPNB		PE

Set: 10.0

Doors: 1-132

3 Hinge, Full Mortise, Hvy Wt	T4A3386 (x NRP @ out-swing doors w/locks)	BSP(SS)	MK
1 Electric Power Transfer	EL-CEPT	BSP	SU ⚡
1 Fail Secure Lock	SI AU 5491LN REX	BSP	YA ⚡
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Door Stop	466-RKW or OH stop where floor stop presents tripping hazard	Black	RO
1 Threshold	Per detail x FHSL14		PE
1 Gasketing	S88BL Width x Height		PE
1 Int. Sweep	18061BSPNB		PE
1 Frame Harness	QC-C1500		MK ⚡
1 Door Harness	QC-C__ (as required)		MK ⚡
1 Card Reader and Power	By Div 28		OT

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Key override provided. Free egress at all times.

Set: 11.0

Doors: 2-140

6 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	US26D	MK
6 Hinge, Full Mortise, Hvy Wt	T4A3386 (x NRP @ out-swing doors w/locks)	BSP(SS)	MK
1 Self-Latching	2845	US32D	RO

Flush Bolt Set Metal			
1 Dust Proof Strike	570	US26D	RO
1 Storeroom or Closet Lock	SI AU 5405LN	BSP	YA
1 Coordinator	1700	Black	RO
Surface Closer, 2 Hold Open Stop Arm	UNI8501H	BSP	NO
2 Armor Plate	K1050 34"H BEV CSK	BSP	RO
1 Threshold	Per detail x FHSL14		PE
1 Rain Guard	346C x full frame width, omit @ overhangs		PE
1 Gasketing	S88BL Width x Height		PE
2 Ext. Sweep	3452BSPNB		PE
1 Overlapping Astragal	357BSP		PE

Set: 12.0

Doors: 2-141, 3-158, 4-111

3 Hinge, Full Mortise	TA2314 (x NRP @ out-swing doors w/locks)	BSP(SS)	MK
1 Storeroom or Closet Lock	SI AU 5405LN	BSP	YA
1 Surface Closer, Stop Arm	CPS8501	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Threshold	Per detail x FHSL14		PE
1 Rain Guard	346C x full frame width, omit @ overhangs		PE
1 Gasketing	S88BL Width x Height		PE
1 Ext. Sweep	3452BSPNB		PE

Set: 13.0

Doors: 4-109

3 Hinge, Full Mortise	TA2314 (x NRP @ out-swing doors w/locks)	BSP(SS)	MK
1 Bathroom Lock w/ Indicator	AUR 8862FL LC V20	BSP	YA
1 Mortise Cylinder	LFIC to match std x req'd cam	Black	SC
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO

1 Mop Plate	K1050 6"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
1 Threshold	Per detail x FHSL14		PE
1 Rain Guard	346C x full frame width, omit @ overhangs		PE
1 Gasketing	S88BL Width x Height		PE
1 Ext. Sweep	3452BSPNB		PE

Set: 14.0

Doors: 2-131, 3-144

3 Hinge, Full Mortise	TA2314 (x NRP @ out-swing doors w/locks)	BSP(SS)	MK
1 Classroom Lock	SI AU 5408LN	BSP	YA
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Wall Stop	406/409 as required	BSP	RO
1 Perimeter Gasketing	By Door Manufacturer		OT

Set: 15.0

Doors: 3-131

2 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Electric Hinge	TA2714-QC	BSP	MK ⚡
1 Fail Secure Lock	SI AU 5491LN REX	BSP	YA ⚡
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
1 Perimeter Gasketing	By Door Manufacturer		OT
1 Frame Harness	QC-C1500		MK ⚡
1 Door Harness	QC-C__ (as required)		MK ⚡
1 Card Reader and Power	By Div 28		OT

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Key override provided. Free egress at all times.

Set: 16.0

Doors: 2-137A, 2-144, 3-155, 4-110A

2 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Electric Hinge	TA2714-QC	BSP	MK ⚡
1 Fail Secure Lock	SI AU 5491LN REX	BSP	YA ⚡
1 Surface Closer, Stop Arm	CPS8501	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
1 Perimeter Gasketing	By Door Manufacturer		OT
1 Frame Harness	QC-C1500		MK ⚡
1 Door Harness	QC-C__ (as required)		MK ⚡
1 Card Reader and Power	By Div 28		OT

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Key override provided. Free egress at all times.

Set: 17.0

Doors: 1-133, 1-134, 1-135

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Mortise Cylinder	LFIC to match std x req'd cam	Black	SC
1 Locking Pull	LP3301DBU ADA LC	BSP	RO
1 Conc Overhead Stop (AL Doors)	6-X36	630	RF
1 Perimeter Gasketing	By Door Manufacturer		OT

Set: 18.0

Doors: 4-102, 4-104

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Mortise Cylinder	LFIC to match std x req'd cam	Black	SC
1 Locking Pull	LP3301DBU ADA LC	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
1 Perimeter Gasketing	By Door Manufacturer		OT

Gasketing

Set: 19.0

Doors: 1-ST-1.1, 3-ST1-1, 3-ST2-1

2 Hinge, Full Mortise, Hvy Wt	T4A3786 (x NRP @ out-swing doors w/locks)	BSP	MK	
1 Electric Hinge, Hvy Wt	T4A3786-QC	BSP	MK	⚡
1 Fire Rated Rim Exit, Nightlatch	7100F B MELR AU627F	BSP	YA	⚡
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO	
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO	
1 Wall Stop	406/409 as required	BSP	RO	
1 Gasketing	S88BL Width x Height		PE	
1 Frame Harness	QC-C1500		MK	⚡
1 Door Harness	QC-C__ (as required)		MK	⚡
1 Card Reader and Power	By Div 28		OT	

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Key override provided. Free egress at all times.

Set: 20.0

Doors: 1-ST-1.2, 1-ST-1.3, 1-ST-1.4, 1-ST-1.5, 1-ST-2.1A, 1-ST-2.1B, 1-ST-2.2, 1-ST-2.3, 1-ST-2.4, 1-ST-2.5, 2-ST-1.1B, 2-ST-1.2, 2-ST-1.3, 2-ST-1.4, 2-ST-1.5, 2-ST-2.1, 2-ST-2.2, 2-ST-2.3, 2-ST-2.4, 2-ST-2.5, 3-ST1-2, 3-ST1-3, 3-ST1-4, 3-ST1-5, 3-ST2-2, 3-ST2-3, 3-ST2-4, 3-ST2-5

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (x NRP @ out-swing doors w/locks)	BSP	MK	
1 Fire Rated Rim Exit, Passage	7100F AU628F	BSP	YA	
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO	
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO	
1 Wall Stop	406/409 as required	BSP	RO	
1 Gasketing	S88BL Width x Height		PE	

Set: 21.0

Doors: 1-100C, 1-200C, 1-300C, 1-400C, 1-500C, 2-100a, 2-130B, 2-130C, 2-130E, 2-200b, 2-300b, 2-400b, 2-500b, 3-100B, 3-100C, 3-100D, 3-400a, 3-500a

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Fire Rated Rim Exit, Passage	7100F AU628F	BSP	YA
1 Surface Closer / Elec Holder	7213MPSO	BSP	NO ⚡
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Gasketing	S88BL Width x Height		PE

Set: 22.0

Doors: 2-134

2 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Electric Hinge	TA2714-QC	BSP	MK ⚡
1 Fail Secure Lock	SI AU 5491LN REX	BSP	YA ⚡
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
3 Silencer	608-RKW		RO
1 Frame Harness	QC-C1500		MK ⚡
1 Door Harness	QC-C__ (as required)		MK ⚡
1 Card Reader and Power	By Div 28		OT

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Key override provided. Free egress at all times.

Set: 23.0

Doors: 1-140, 1-146, 2-230, 2-330, 3-143, 3-230, 3-330, 3-430, 3-530

2 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Electric Hinge	TA2714-QC	BSP	MK ⚡
1 Fail Secure Lock	SI AU 5491LN REX	BSP	YA ⚡
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
1 Gasketing	S88BL Width x Height		PE

1 Frame Harness	QC-C1500		MK	⚡
1 Door Harness	QC-C__ (as required)		MK	⚡
1 Card Reader and Power	By Div 28		OT	

Notes: Door normally closed and secure. Valid credential presented to card reader allows temporary access. Upon loss of power, door remains secure. Key override provided. Free egress at all times.

Set: 24.0

Doors: 1-143, 5-102, 5-103

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Storeroom or Closet Lock	SI AU 5405LN	BSP	YA
1 Wall Stop	406/409 as required	BSP	RO
3 Silencer	608-RKW		RO

Set: 25.0

Doors: 1-141, 1-144, 1-145, 1-531, 1-MECH, 1-ST-1.6, 2-136B, 2-430, 2-530, 2-600, 2-601, 3-130, 3-151B, 3-333, 3-533, 3-630, 3-ST2-6, 2-137B

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Storeroom or Closet Lock	SI AU 5405LN	BSP	YA
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
1 Gasketing	S88BL Width x Height		PE

Set: 25.1

Doors: 1-232, 1-332, 1-432, 1-532

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Storeroom or Closet Lock	SI AU 5405LN	BSP	YA
1 Surface Closer, Stop Arm	CPS8501	BSP	NO

1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Gasketing	S88BL Width x Height		PE

Set: 26.0

Doors: 3-232, 3-234, 3-332, 3-532

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Mortise Cylinder	LFIC to match std x req'd cam	Black	SC
1 Locking Pull	LP3301DBU ADA LC	BSP	RO
1 Conc Overhead Stop (AL Doors)	6-X36	630	RF
1 Gasketing	S88BL Width x Height		PE

Set: 27.0

Doors: 1-101, 1-102, 1-103, 1-105, 1-106, 1-107, 1-108, 1-109, 1-110, 1-111, 1-112, 1-113, 1-114, 1-115, 1185, 1-201, 1-202, 1-203, 1-204, 1-205, 1-206, 1-207, 1-208, 1-209, 1-210, 1-211, 1-212, 1-213, 1-214, 1-215, 1-216, 1-217, 1-218, 1-219, 1-301, 1-302, 1-303, 1-304, 1-305, 1-306, 1-307, 1-308, 1-309, 1-310, 1-311, 1-312, 1-313, 1-314, 1-315, 1-316, 1-317, 1-318, 1-319, 1-401, 1-402, 1-403, 1-404, 1-405, 1-406, 1-407, 1-408, 1-409, 1-410, 1-411, 1-412, 1-413, 1-414, 1-415, 1-416, 1-417, 1-418, 1-419, 1-501, 1-502, 1-503, 1-504, 1-505, 1-506, 1-507, 1-508, 1-509, 1-510, 1-511, 1-512, 1-513, 1-514, 1-515, 1-516, 1-517, 1-518, 1-519, 2-101, 2-102, 2-103, 2-104, 2-106, 2-110, 2-111, 2-112, 2-113, 2-114, 2-115, 2-116, 2-118A, 2-201, 2-202, 2-203, 2-204, 2-205, 2-206, 2-207, 2-208, 2-209, 2-210, 2-211, 2-212, 2-213, 2-214, 2-215, 2-216, 2-218, 2-301, 2-302, 2-303, 2-304, 2-305, 2-306, 2-307, 2-308, 2-309, 2-310, 2-311, 2-312, 2-313, 2-314, 2-315, 2-316, 2-318, 2-401, 2-402, 2-403, 2-404, 2-405, 2-406, 2-407, 2-408, 2-409, 2-410, 2-411, 2-412, 2-413, 2-414, 2-415, 2-416, 2-418, 2-501, 2-502, 2-503, 2-504, 2-505, 2-506, 2-507, 2-508, 2-509, 2-510, 2-511, 2-512, 2-513, 2-514, 2-515, 2-516, 2-518, 3-101, 3-102, 3-103, 3-104, 3-105, 3-106, 3-108, 3-113, 3-114, 3-115, 3-116, 3-117, 3-118, 3-201, 3-202, 3-203, 3-204, 3-205, 3-206, 3-207, 3-208, 3-209, 3-210, 3-211, 3-212, 3-213, 3-214, 3-215, 3-216, 3-217, 3-218, 3-301, 3-302, 3-303, 3-304, 3-305, 3-306, 3-307, 3-308, 3-309, 3-310, 3-311, 3-312, 3-313, 3-314, 3-315, 3-316, 3-317, 3-318, 3-401, 3-402, 3-403, 3-404, 3-405, 3-406, 3-407, 3-408, 3-409, 3-410, 3-411, 3-412, 3-413, 3-414, 3-415, 3-416, 3-417, 3-418, 3-501, 3-502, 3-503, 3-504, 3-505, 3-506, 3-507, 3-508, 3-509, 3-510, 3-511, 3-512, 3-513, 3-514, 3-515, 3-516, 3-517, 3-518

Description: UNIT ENTRY

1 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	US26D	MK
2 Hinge, Spring	1502	US26D	MK
1 Entrance or Apartment Lock	AUR 8847FL LC	626	YA
1 Wall / Door / Hinge Pin Stop	409/ 525 / 528 as req'd	NP	RO
1 Threshold	Per detail x FHSL14		PE
1 Gasketing	S88BL Width x Height		PE

1 Unit Door Bottom	2113AV		PE
1 Viewer	627 (2 ea. @ accessible units)	CRM	RO

Set: 28.0

Doors: E1, E2

Description: UNIT LAUNDRY CLOSET

6 Hinge	1414	US26D	MK
2 Single Dummy	81 VL	626	YR
2 Roller Latch	911RC	US26D	RO
2 Wall / Door / Hinge Pin Stop	409/ 525 / 528 as req'd	NP	RO
2 Silencer	609		RO

Set: 29.0

Doors: 4-103

4 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Classroom Lock	SI AU 5408LN	BSP	YA
1 Wall Stop	406/409 as required	BSP	RO
3 Silencer	608-RKW		RO

Set: 30.0

Doors: 1-150, 1-233, 1-333, 1-533, 2-136A, 2-231, 2-331, 2-431, 2-531, 3-150A, 3-238, 3-338, 3-438, 3-538

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Classroom Lock	SI AU 5408LN	BSP	YA
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
1 Gasketing	S88BL Width x Height		PE

Set: 30.1

Doors: 1-433, 2-232, 2-332, 2-432, 2-532, 3-234, 3-334, 3-434, 3-534

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Classroom Lock	SI AU 5408LN	BSP	YA
1 Surface Closer	8501 DA	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
1 Gasketing	S88BL Width x Height		PE

Set: 31.0

Doors: 1-231, 1-235, 1-331, 1-335, 1-431, 1-435, 1-535, 3-141

Description: RESIDENT STORAGE

1 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
2 Hinge, Spring	1502	BSP	MK
1 Classroom Lock	SI AU 5408LN	BSP	YA
1 Wall Stop	406/409 as required	BSP	RO
1 Gasketing	S88BL Width x Height		PE

Set: 32.0

Doors: 1-230, 1-330, 1-430, 1-530

Description: RESIDENT STORAGE

1 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
2 Hinge, Spring	1502	BSP	MK
1 Classroom Lock	SI AU 5408LN	BSP	YA
1 Overhead Stop	OH203M	US32D	RO
1 Gasketing	S88BL Width x Height		PE

Set: 33.0

Doors: 157, B, C

Description: UNIT PRIVACY

1 Hinge	1414	US26D	MK
1 Privacy Lock	21 VL	626	YR
1 Wall / Door / Hinge Pin Stop	409/ 525 / 528 as req'd	NP	RO
3 Silencer	609		RO

Set: 34.0

Doors: 1-147, 2-135, 3-132B, 3-132C, 3-157, 4-108, 5-101

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Bathroom Lock w/ Indicator	AUR 8862FL LC V20	BSP	YA
1 Mortise Cylinder	LFIC to match std x req'd cam	Black	SC
1 Surface Closer	8501 reg/par arm to suit location	BSP	NO
1 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Mop Plate	K1050 6"H BEV CSK	BSP	RO
1 Wall Stop	406/409 as required	BSP	RO
3 Silencer	608-RKW		RO

Set: 35.0

Doors: 2-200, 2-300, 2-400, 2-500, 3-231, 3-331, 3-431, 3-531

6 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
Self latching top			
1 bolt only - Wood door	2905	US32D	RO
1 Passage Latch	AU 5401LN	BSP	YA
2 Surface Closer / Elec Holder	7213MPSO	BSP	NO ⚡
2 Kick Plate	K1050 10"H BEV CSK	BSP	RO
1 Gasketing	S88BL Width x Height		PE
2 Adhesive Astragal	S772BL		PE

Set: 36.0

Doors: 1-177, D, D4

Description: UNIT CLOSET

3 Hinge	1414	US26D	MK
1 Passage Latch	11 VL	626	YR
1 Wall / Door / Hinge Pin Stop	409/ 525 / 528 as req'd	NP	RO
3 Silencer	609		RO

Set: 37.0

Doors: 1-100B, 3-200a, 3-300a

3 Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1 Passage Latch	AU 5401LN	BSP	YA
1 Surface Closer / Elec Holder	7213MPSO	BSP	NO ⚡
1 Gasketing	S88BL Width x Height		PE

Set: 38.0

Doors: 6528

Description: UNIT POCKET DOOR

1 Pocket Door Hdwe	PF28200A Series		PE
1 Pocket Door Latch	891	US26D	RO

Set: 39.0

Doors: 1-342, 159, G2, G3, G4, G5

Description: UNIT BY-PASS CLOSET

1 Sliding Door Hdwe	HBP200A		PE
1 Fascia	F134C		PE
2 Flush Pull	870	US32D	RO

Notes: At accessible units, furnish BF97L pulls in lieu of specified pulls.

Set: 40.0

Doors: 2-132, 2-133, 3-142

1 Sliding System	BLD-FT-01BSP		PE
2 Door Pull	RM3340-36 Mtg-Type 5HD	BSP	RO

Notes: Install track stops such that door pulls do not hit cased open jamb. Maintain minimum 32" clearance.

Set: 41.0

Doors: 2743, H1, H2, H3

Description: UNIT TRIPLE-PANEL BYPASS

1	Triple Panel ByPass Track	By Others		OT
3	Flush Pull	870	US32D	RO

Set: 42.0

Doors: 2449

Description: UNIT BARN DOOR

1	Sliding System	BLD-FT-01BSP		PE
2	Door Pull	106-RKW Mtg-Type 5	US26D	RO

Set: 43.0

Doors: 1-137, 2-ST-1.1C, 4-105, 4-107A, 4-110B, P1, P2, P3, P4, P5, P7

1	All Hardware	By Door Manufacturer		OT
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Set: 44.0

Doors: 243B

3	Hinge, Full Mortise	TA2714 (x NRP @ out-swing doors w/locks)	BSP	MK
1	Passage Latch	AU 5401LN	BSP	YA
1	Surface Closer, Stop Arm	CPS8501	BSP	NO
1	Kick Plate	K1050 10"H BEV CSK	BSP	RO
3	Silencer	608-RKW		RO

END OF SECTION 087100

SECTION 08 71 13
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Low energy automatic door operators for swinging doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 01 Section "Cash Allowances".
3. Division 01 Section "Product Allowances".
4. Division 01 Section "Closeout Procedures".
5. Division 08 Section "Door Schedule".
6. Division 08 Section "Hollow Metal Doors and Frames".
7. Division 08 Section "Interior Aluminum Doors and Frames".
8. Division 08 Section "Flush Wood Doors".
9. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
10. Division 08 Section "Door Hardware".
11. Division 26 Section "Electrical".
12. Division 28 Section "Access Control".

A. Codes and Standards: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI/BHMA A156.4 - Door Controls, Door Closers.
3. ANSI/BHMA A156.19 - Power Assist and Low-Energy Power Operated Doors.
4. ICC/IBC - International Building Code.
5. NFPA 70 - National Electrical Code.
6. NFPA 80 - Fire Doors and Windows.
7. NFPA 101 - Life Safety Code.
8. NFPA 105 - Installation of Smoke Door Assemblies.
9. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
10. UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.
11. State Building Codes, Local Amendments.

1.3 PERFORMANCE REQUIREMENTS

- A. Automatic door operators to be used on interior or exterior doors; up to 200 pounds (91 kg) weight and maximum door width of 48" (1219 mm).
 - 1. Auto door operator capable of operating within temperature ranges of -22°F (-30°C) and 122°F (50°C).

1.4 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including activation devices. Include operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: Include details and attachments to other work.
 - 1. Include locations and elevations of each unique entrance showing activation devices.
 - 2. Indicate required clearances, components, and location and size of field connections.
 - 3. Wiring Diagrams: For power, signal, and activation wiring.
- C. Qualification Data: Provide copy of manufacturer's official certification or accreditation document indicating proof of status as a qualified and authorized installer of automatic door operators and accessories.
- D. Operating and Maintenance Manuals: Provide manufacturer's operating and maintenance manual for each item comprising the automatic door operator installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturer and Installer providing the operators and installation. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
- B. Certified Installer Qualifications: Power operator products and accessories are required to be supplied and installed through the Norton Preferred Installer (NPI) program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.
- C. Source Limitations: Obtain automatic door operators, including activation devices, from single source, qualified supplier unless otherwise indicated.

- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
- E. Exit Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.
- F. Fire Rated Door Assemblies: Provide operators for fire rated door assemblies that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.
- G. Building Information Modeling (BIM) Qualifications: BIM software tools and processes are used to produce and support data integration of product and technical information used in specifications, submittals, project reviews, decision support, and quality assurance during all phases of Project design, construction, and facility management. Door and hardware schedules and the associated product data parameters are to be derived, updated, and fully integrated with the coordinated Building Information Modeling as required under Division 01.
- H. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.
- I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and the procedures for receiving, handling, and installing automatic door operators.
 - 1. Prior to installation of automatic door operators, arrange for certified Installer's representative to conduct a project specific meeting to review the installation and maintenance of their respective products. Project meeting to be attended by representatives of related trades furnishing and installing the aluminum, hollow metal and wood doors sections.
 - 2. Review and finalize construction schedule and verify availability of materials.

1.6 COORDINATION

- A. Electrical Systems Coordination: Coordinate the layout and installation of scheduled automatic door operators and related activation devices, with required connections to source power junction boxes, remote power supplies, access control equipment, detection and monitoring hardware, and fire alarm system.
- B. Templates: Obtain and distribute to the parties involved, templates for doors, frames, operators, and other work specified to be factory prepared and reinforced for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive

the installation of the specified automatic door operators without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer, agreeing to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period after final acceptance by Owner. Failures include, but are not limited to, the following:
 - 1. Faulty or sporadic operation of automatic door operator, including activation and safety devices.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
- C. Special Warranty Period: Two years from date of Substantial Completion.
- D. Provide extended warranty from defects in material or workmanship under normal use for a period of 3 years from the date of substantial completion for units installed by a certified ASSA ABLOY Power Operator Preferred Installer in accordance with the manufacturer's written warranty certificate.

1.8 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance by skilled employees of automatic door operator Installer. Include planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
- B. Extended Maintenance Support and Service Agreement: Submit for Owner's consideration an optional extended Service Agreement for the installed automatic door operator system. The extended Service Agreement is considered elective and is without manufacturer's requirement stipulating mandatory coverage for owner and/or vendor system support.
 - 1. A published copy of this agreement to be included with the submittal package
 - 2. Support for the installed automatic door operator system is provided through the vendor under a specified, limited 24 hour support program.
 - 3. Automatic door operators and components are to be available on a one-day turn around time frame from the vendor.

PART 2 - PRODUCTS

2.1 ELECTROMECHANICAL DOOR OPERATORS

- A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
 - 1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
- B. Standard: Certified ANSI/BHMA A156.19.
- C. Performance Requirements:
 - 1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
 - 2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.
- D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.
- E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.
- F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
- G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Norton Door Controls (NO) - 6300 Series.

2.2 ELECTROHYDRAULIC DOOR OPERATORS

- A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
 - 1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
- B. Standard: Certified ANSI/BHMA A156.19.
- C. Performance Requirements:
 - 1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
 - 2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.
- D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.
- E. Certification: Furnish Operators with GreenCircle Certification.
- F. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.
- G. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
- H. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- I. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- J. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. LCN Closers (LC) - 4640 Series.
 - 2. Norton Door Controls (NO) - 6000 Series.

2.3 ACTIVATION DEVICES

- A. General: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.
- B. Touch Less Wall Switch: Momentary contact door control switch with movement required activation. Single or double gang box junction box mounting.
 - 1. Doppler radar sensor.
 - 2. Mounting Location: As indicated on Drawings.
 - 3. Manufacturers:
 - a. Norton Door Controls (NO) – 700 Series.
 - b. Securitron (SU) – WSS Series.

2.4 ACCESSORIES

- A. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.

2.5 FINISHES

- A. Standard: Designations used to indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware. Units will be sprayed with a combination of waterborne acrylic and polyester powder coat.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.6 OPENING LABELS

- A. Provide 1"W x 2"H gloss polyester label imprinted with door mark and QR-type code readable via IR and visible light scan. QR code links to a security credential protected site displaying the installed door opening information. Label constructed with a high-performance, permanent acrylic adhesive resistant to chemicals, smear and scratch, and repeated freeze and thaw cycles. Face stock of label to be white or clear coated, 2.0 mil thickness with tensile strength meeting or exceeding 18,000 psi.
 - 1. Approved Manufacturer: Openings Studio™ Smart Tags (AA).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, power connections, electrical systems interfaces, and other conditions affecting performance of automatic door operators.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 INSTALLATION

- A. General: Install complete automatic door operators according to manufacturer's written instructions and ANSI/BHMA A156.19 standard, including activation devices, control wiring, remote power units if any, connection to the building's fire alarm system, and required signage.
- B. Power Connection: Reference Division 26 "Electrical" Sections for connection to electrical power distribution system.
- C. Access Control System: Coordinate connections and operation with access control system
- D. Signage: Apply signage as required by ANSI/BHMA A156.19 standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.
 - 2. Submit documentation of incomplete items in the following formats:
 - a. PDF electronic file.
 - b. Electronic formatted file integrated with the Openings Studio™ door opening management software platform.

3.4 ADJUSTING

- A. Comply with requirements of ANSI/BHMA A156.19 standard. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer.

3.5 DEMONSTRATION

- A. Certified Installer's representative to provide eight (8) hours of training to Owner's maintenance personnel in the proper adjustment, operation, and maintenance of automatic door operators.

END OF SECTION 087113

**SECTION 08 80 00
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds.

1.02 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. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- E. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- F. ASTM C1036 - Standard Specification for Flat Glass 2021.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.
- I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.
- L. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.
- M. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.
- N. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Insulating Glass Certification: Permanently mark on each unit with appropriate certification label of Insulating Glass Certification Council.
- B. Fabricator Qualifications: Company specializing in performing the work of this section shall be certified and approved by glass manufacturer.
 - 1. Production line and equipment used shall be certified by glass manufacturer.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- D. Fabrication Tolerances
 - 1. Wave Distortion Tolerance: Not to exceed 0.003 inches (0.076mm) from peak to valley in the center of lites, and a maximum of 0.008 inches (0.20mm) within 10.5 inch (267mm) of the leading or trailing edge.
 - 2. Warp Tolerance: Rectangular glass to be 1/32 inch (0.8mm) over any 12 inches (305mm) but limited to 5/16 inches.
 - 3. Install glazed units with wave orientation in same direction: horizontal to ground.
- E. Source Limitations: Provide glass materials from one primary glass manufacturer for each type of glass specified.
 - 1. Insulating Glass: Obtain components for each type of unit from same source as used in other applications for same components.
 - 2. Provide glazing accessories from one source for each product and installation method indicated.
- F. Safety Glazing Identification: Provide identification to glazed surface such as; sand blasted, ceramic fired, laser etched, embossed, or of a type once applied cannot be removed without being destroyed. Glazed identification to remain visible in assembled unit.

1.05 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Provide mock-up of each insulated glazing Type including glass and air barrier and vapor retarder seal.
 - 1. Size: 4 x 4 foot.
 - 2. Provide mock-up samples before glass is ordered or fabricated.
 - 3. Verify with Owner and Architect Wave Distortion and Warp Tolerance are visually acceptable.
- C. Mock-ups may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver with original labels showing Manufacturer, each piece of glass. Maintain labels on glass until cleaning for Substantial Completion.
- B. Protect from damage and handle glazing materials according to manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. Coated Glass: Provide a ten (10) year warranty to include labor and materials for coated glass to replace unit deterioration including peeling, cracking, and other indications of deterioration in metallic coating.
- D. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with ASCE 7 and per Structural drawings design criteria.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7
 - 4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 5. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
 - 1. In conjunction with weather barrier related materials described in other sections.
 - 2. To maintain a continuous vapor retarder and/or air barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's

published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 5. Heat-Soak Testing (HST): Provide HST of fully tempered glass used on canopy, point-supported, spider wall, high-risk, sloping overhead, horizontal overhead, free-standing glass protective barrier, or other demanding applications of project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with industry established testing requirements.
 6. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172 and ASTM B117.
 1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
 2. Ionoplast Interlayer: 0.035 inch thick, minimum.

2.03 EXTERIOR GLAZING UNITS

- A. Manufacturers:
 1. Basis of Design: Vitro Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
 2. Cardinal Glass Industries: www.cardinalcorp.com.
 3. Pilkington North America Inc: www.pilkington.com/na.
 4. Viracon, Apogee Enterprises, Inc: www.viracon.com.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
- C. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Warm Edge Spacers: Polypropylene and stainless steel warm-edge technology design.
 - a. Spacer Width: As required for specified insulating glass unit.
 - b. Spacer Height: Manufacturer's standard.
 4. Spacer Color: Black.

5. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
6. Color: Black.
7. Purge interpane space with dry air, hermetically sealed.
- D. Type GL-1 - Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Storefront glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Solarban 70XL, on #2 surface.
 4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 5. Total Thickness: 1 inch.
 6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.28, nominal.
 7. Visible Light Transmittance (VLT): 64 percent, nominal.
 8. Solar Heat Gain Coefficient (SHGC): 0.27, nominal.
- E. Type GL-2 - Insulating Glass Units: Safety glazing.
 1. Applications:
 - a. Glazed lites in exterior doors.
 - b. Glazed sidelights and panels next to doors.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 2. Space between lites filled with air.
 3. Glass Type: Same as Type GL-1 except use fully tempered float glass for both outboard and inboard lites.
 4. Tint: Clear.
 5. Total Thickness: 1 inch.
 6. Metal edge spacer.

2.04 INTERIOR GLAZING UNITS

- A. Type GL-20 - Monolithic Interior Vision Glazing:
 1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Annealed float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch, nominal.
- B. Fire-Resistance-Rated Glazing: See Section 08 88 13 - Fire Rated Glazing.
- C. Type GL-21 - Monolithic Safety Glazing: Non-fire-rated.
 1. Applications:
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.

2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.

2.05 PLASTIC FILMS

- A. Type DGF-1 - Decorative film glazing.
 1. Application: Locations as indicated on drawings.
 2. Series Type: See Section 09 06 02 Materials and Finishes Schedule.
 3. Color: As scheduled.
 4. Manufacturers:
 - a. See Section 09 06 02 Materials and Finishes Schedule.
 - b. Avery Dennison; Design Window Films: www.averydennison.com/#sl.

2.06 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing U-Channels:
 1. Material: Aluminum.
 2. Glass Size: 3/8 inch.
 3. Top Channel: 1 x 1-1/2 inch U-Channel.
 4. Bottom Channel: 1 x 1 inch U-Channel.
 5. Manufacturers:
 - a. C.R. Laurence Co., Inc.; Product: CRL Shallow and Deep Wet/Dry Glaze U-Channels; www.crlaurence.com.
 - b. Substitutions: Refer to Section 01 60 00 - Product Requirements.
 6. Finish: Satin.
- D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

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.
 1. Verify dimensions prior to fabrication; if vary significantly from Contract Documents, obtain Architect's approval before proceeding.
- 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 presence and functioning of weep system.
- E. Verify minimum required face or edge clearances.

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. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- D. 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. Owner will employ independent testing agency to test two fabricated units prior to installation for wave distortion and warp tolerance in accordance with requirement specified.
- 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. Replace broken, cracked, scratched, or otherwise damaged glass.
- B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- C. Remove nonpermanent labels immediately after glazing installation is complete.
- D. Clean glass and adjacent surfaces after sealants are fully cured.
- E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

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. Do not store materials close enough to glass to create a heat trap and cause breakage.
- C. Protect glass surfaces adjacent to or below exterior concrete and masonry surfaces from build up of dirt, scum, alkaline deposits, or stains.
- D. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 83 00
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass mirrors.

1.02 REFERENCE STANDARDS

- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- B. ASTM C1036 - Standard Specification for Flat Glass 2021.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.05 FIELD CONDITIONS

- A. Do not install mirrors when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 MATERIALS

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Mirror Glass : Clear float type with copper and silver coating, organic overcoating, arrised edges, 1/4 inch thick minimum.
 - 1. Size: As scheduled.
 - 2. Edges: Polished or bevel per schedule

2.03 GLAZING COMPOUNDS

- A. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Uses M and A; single component; chemical or solvent curing; non-bleeding, non-staining, cured Shore A hardness of 15 to 25; color as selected.

2.04 ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.
- C. Glazing Clips: Manufacturer's standard type.
- D. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for mirrored glazing are correctly sized and within tolerance.
- B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.
- C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install mirrors in accordance with manufacturer's recommendations.
- B. Set mirrors plumb and level, and free of optical distortion.

- C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.
- D. Frameless Mirrors: Set mirrors in proper place with adhesive, applied in accordance with adhesive manufacturer's instructions.

3.04 CLEANING

- A. Remove wet glazing materials from finish surfaces.
- B. Remove labels after work is complete.
- C. Clean mirrors and adjacent surfaces.

3.05 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

**SECTION 08 88 13
FIRE RATED GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire rated glazing in the following locations:
 - 1. Doors
 - 2. Sidelights and transoms
 - 3. Relites (Also known as Borrowed Lights)

1.02 REFERENCE STANDARDS

- A. NFPA 251 - Standard Methods of Tests of Fire Resistance of Building Construction and Materials; Current Edition

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Shop Drawings: Indicate location of each glazing type, including applicable fire ratings. Include details of installation as required to meet rating.

1.04 QUALITY ASSURANCE

- A. Insulating Glass Certification: Permanently mark on each unit with appropriate certification label of Insulating Glass Certification Council.
- B. Fabricator Qualifications: Company specializing in performing the work of this section shall be certified and approved by glass manufacturer.
 - 1. Production line and equipment used shall be certified by glass manufacturer.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- D. Fabrication Tolerances
 - 1. Wave Distortion Tolerance: Not to exceed 0.003 inches (0.076mm) from peak to valley in the center of lites, and a maximum of 0.008 inches (0.20mm) within 10.5 inch (267mm) of the leading or trailing edge.
 - 2. Warp Tolerance: Rectangular glass to be 1/32 inch (0.8mm) over any 12 inches (305mm) but limited to 5/16 inches.
- E. Source Limitations: Provide glass materials from one primary glass manufacturer for each type of glass specified.
 - 1. Insulating Glass: Obtain components for each type of unit from same source as used in other applications for same components.
 - 2. Provide glazing accessories from one source for each product and installation method indicated.

- F. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver with original labels showing Manufacturer, each piece of glass. Maintain labels on glass until cleaning for Substantial Completion.
- B. Protect from damage and handle glazing materials according to manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
- C. Coated Glass: Provide a ten (10) year warranty to include labor and materials for coated glass to replace unit deterioration including peeling, cracking, and other indications of deterioration in metallic coating.
- D. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including replacement of failed units.
- E. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. SAFTIFIRST, a division of O'Keefe's Inc; www.safti.com/sle
- B. Technical Glass Products (TGP); www.fireglass.com
- C. Vetrotech Saint-Gobain North America; www.vetrotechusa.com

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-rated glazing to be labeled and conform to the following:
 - 1. Glazing marked 'W' meets the qualifications of a wall assembly in accordance with ASTM E 119 or UL 263
 - 2. Glazing marked 'OH' meets the qualifications of a fire window assembly, including the hose stream test in accordance with NFPA 257 or UL 9
 - 3. Glazing marked 'D' meets the fire door assembly criteria in accordance with NFPA 252, UL 10B or UL 10C
 - 4. Glazing marked 'H' meets the fire door assembly 'Hose Stream' test in accordance with NFPA 252, UL 10B or UL 10C

5. Glazing marked 'T' meets 450 degree Fahrenheit temperature rise criteria for 20 minutes in accordance with NFPA 252, UL 10B or UL 10C

2.03 FIRE RATED GLAZING

A. GL-40: Fire Protection Rated Glazing

1. Fire Test Standard:
 - a. One of the following: NFPA 252, UL 10B or UL 10C.
2. Rating: 20 Minutes
3. Glass Marking: D-20
4. Thickness: 1/4" minimum (6mm) or as required by manufacturer to meet required rating
5. Product:
 - a. TGP: Fireglass 20
 - b. O'Keefe: SuperLite 20
 - c. Vetrotech: Pyroswiss 20
6. Applications:
 - a. 20 minute rated doors in corridor fire partition walls
 - b. 20 minute rated doors in smoke barrier walls

B. GL-41: Fire Protection Rated Glazing

1. Fire Test Standard:
 - a. One of the following: NFPA 252, UL 10B or UL 10C
 - 1) Glazing in doors: NFPA 252, UL 10B or UL 10C
 - 2) Sidelights and transoms: NFPA 257 or UL 9
2. Rating: 20 Minutes
3. Glass Marking: D-H-20
 - a. Doors: D-H-20
 - b. Sidelights and transoms: D-H-OH-20
4. Thickness: 3/16" minimum (5mm) or as required by manufacturer to meet required rating
5. Product:
 - a. TGP: FireLite Plus
 - b. O'Keefe: PYRAN Platinum F
 - c. Vetrotech: Keralite L
6. Applications:
 - a. 20 minute rated doors in fire partitions other than corridors
 - b. Transom and sidelight panels adjacent to 20 minute rated doors in fire partitions

C. GL-42: Fire Protection Rated Glazing

1. Fire Test Standard:
 - a. One of the following:
 - 1) Glazing in doors: NFPA 252, UL 10B or UL 10C
 - 2) Sidelights and transoms: NFPA 257 or UL 9
2. Rating: 45 Minutes
3. Glass Marking:
 - a. Doors: D-H-45
 - b. Sidelights and Transoms: D-H-OH-45
4. Thickness: 3/16" minimum (5 mm) or as required by manufacturer to meet required rating

5. Product:
 - a. Laminated:
 - 1) TGP: FireLite Plus
 - 2) O'Keefe: PYRAN Platinum L
 - 3) Vetrotech: Keralite L
 - b. Filmed:
 - 1) TGP: FireLite NT
 - 2) O'Keefe: PYRAN Platinum F
 - 3) Vetrotech: Keralite F
 6. Applications:
 - a. 45 minute rated doors in fire partitions other than corridors
 - b. 45 minute rated doors in exterior walls
 - c. 45 minute rated doors in fire barriers
 - d. Transom and sidelight panels adjacent to 45 minute rated doors in fire partitions, fire barriers and smoke barriers.
 - e. Transom and sidelight panels adjacent to 45 minute rated doors in exterior walls
- D. GL-44: Fire Protection Rated Glazing
1. Fire Test Standard:
 - a. One of the following: NFPA 252, UL 10B or UL 10C
 2. Rating: 90 Minutes
 3. Glass Marking: D-H-90
 4. Thickness: 3/16" minimum (5 mm) or as required by manufacturer to meet required rating
 5. Product:
 - a. Laminated:
 - 1) TGP: FireLite Plus
 - 2) O'Keefe: PYRAN Platinum L
 - 3) Vetrotech: Keralite L
 - b. Filmed:
 - 1) TGP: FireLite NT
 - 2) O'Keefe: PYRAN Platinum F
 - 3) Vetrotech: Keralite F
 6. Applications:
 - a. Vision lites up to 100 square inches, in 90 minute rated doors in Fire Walls and Fire Barriers up to 2 hour rated not enclosing Exit Passageways, Interior Exit Stairs and Ramps.
 - b. Vision lites up to 100 square inches, in 90 minute rated doors in 2 hour rated fire barriers enclosing Shafts, Interior Exit Stairways and Ramps.
 - c. Vision lites up to 100 square inches, in 90 minute rated doors in exterior walls

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.

1. Verify dimensions prior to fabrication; if vary significantly from Contract Documents, obtain Architect's approval before proceeding.
- 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 minimum required face or edge clearances.

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. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- D. 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. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

3.05 CLEANING

- A. Replace broken, cracked, scratched, or otherwise damaged glass.
- B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- C. Remove non-permanent labels immediately after glazing installation is complete.
- D. Clean glass and adjacent surfaces after sealants are fully cured.
- E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

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. Do not store materials close enough to glass to create a heat trap and cause breakage.
- C. Protect glass surfaces adjacent to or below exterior concrete and masonry surfaces from build up of dirt, scum, alkaline deposits, or stains.
- D. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.07 CLOSEOUT ACTIVITIES

END OF SECTION

SECTION 08 91 00
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Louvers, frames, and accessories.

1.02 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2012 (Reapproved 2015).
- D. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices 2021.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- G. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; Louver attachment to opening; head, jamb and sill details; blade configuration, screens, blankout areas required, self-adhered membrane flashings and frames.
 - 1. Include structural calculations indicating compliance with wind loading requirements.
- D. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include lubrication schedules, adjustment requirements.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.05 PROJECT CONDITIONS

- A. Coordinate work of this section with installation of metal siding.
- B. Coordinate work of this section with installation of mechanical ductwork and electrical services to motorized devices.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
 - 1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Louvers:
 - 1. Basis of Design: Construction Specialties, Inc; A4177: www.c-sgroup.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Vents:
 - 1. Basis of Design: XVent Box Ventilation Systems: www.xventbox.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS

- A. Description: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
 - 1. Wind Load Resistance: Design to resist positive and negative wind load as indicated on Structural Drawings without damage or permanent deformation.
 - 2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
 - 3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
 - 4. Screens: Provide bird screens at exhaust louvers.
 - 5. Flanges: Provide 2 inch welded flanges, 4 sides, with welded corners.
- B. Stationary Louvers: Horizontal blade, extruded aluminum construction, with intermediate mullions matching frame.
 - 1. Application: Building Exhaust.
 - 2. Size: As scheduled on drawings.
 - 3. Free Area: 50 percent, minimum.
 - 4. Blades: Drainable.
 - 5. Frame: 4 inches deep, channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
 - 6. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.

7. Aluminum Finish: High performance organic coatings; finish welded units after fabrication.
8. Back support as needed for wind loads to prevent permanent deformation.

2.03 VENTS

- A. Type: L1: Triple V Box, molded vents for exhaust and intake ventilation with back draft damper.
 1. Application: Termination of Unit exhaust as noted on drawings.
 2. Model: S Series - THEB-446L-S.
 3. Material: Plastic polymer consisting of fiberglass reinforced, flame retardant with UV inhibitors polypropylene.
 4. Dimensions : 12.125 inches (15.750 inches with flange) wide by 8.125 (11.625 inches with flange) inches high by 9.125 inches deep.
 5. Duct Connection Sizes: 4, 4, and 6 inch ducts.
 6. Flame Spread: 0 per UL 94.
 7. Color: Custom color match Architect's sample.
- B. Type: L1.2: Single V Box, molded vent for exhaust of portable air conditioners with backdraft damper.
 1. Application: Termination of Unit exhaust as noted on drawings.
 2. Model: EXAP6.
 - a. Louver: 6SEB-S.
 3. Material: Plastic polymer consisting of fiberglass reinforced, flame retardant with UV inhibitors polypropylene.
 4. Dimensions :
 - a. Inside Collar: 8.7 inches (with flange) wide by 8.7 (with flange) inches high by 1.4 inches thick.
 - b. Face Plate: 8.2 inches (with flange) wide by 8.2 (with flange) inches high by 0.6 inches thick.
 5. Duct Connection Sizes: 6 inch ducts. Provide adjustable extension sleeve.
 6. Flame Spread: 0 per UL 94.
 7. Color: Custom color match Architect's sample.
- C. Type: L1.3: Triple V Box, molded vents for exhaust and intake ventilation with back draft damper.
 1. Application: Termination of Unit exhaust as noted on drawings.
 2. Model: S Series - TVEB-446-S.
 3. Material: Plastic polymer consisting of fiberglass reinforced, flame retardant with UV inhibitors polypropylene.
 4. Dimensions : 8.125 inches (11.625 inches with flange) wide by 12.125 (15.750 inches with flange) inches high by 10 inches deep.
 5. Duct Connection Sizes: 4, 4, and 6 inch ducts.
 6. Flame Spread: 0 per UL 94.
 7. Color: Custom color match Architect's sample.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T-5 temper.

2.05 FINISHES

- A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
- B. 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.
- C. Color: As indicated on drawings.

2.06 ACCESSORIES

- A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.
- B. Bird Screen: Interwoven 1/4 inch stainless steel wire mesh, 0.032 inch diameter wire, and 0.218 inch, 76 percent open weave, square design.
- C. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
- D. Insect Screen: 18 x 16 size aluminum mesh.
- E. Fasteners and Anchors: Stainless steel.
- F. Snap-on Perimeter Cover: Frame of same material as louver and provided by Louver Manufacturer.
- G. Flange Angle: 2 x 2 inch galvalume angle, color and finish to match louver, attached to louver and set in bed of sealant on all 4 sides of louver.
- H. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.
- I. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.
 - 1. Sequence work with self-adhered membrane flashing in Section 07 25 11.
- B. Verify that field measurements are as indicated.

3.02 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louver frames in openings with concealed fasteners.

- E. Install perimeter sealant and backing rod in accordance with 07 92 00.

3.03 ADJUSTING

- A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.04 CLEANING

- A. Strip protective finish coverings.
- B. Clean surfaces and components.
- C. Remove from jobsite refuse and debris created and dispose per Section 01 74 19.

END OF SECTION

ROOM FINISH SCHEDULE MATERIAL DESIGNATIONS

ACT	Acoustical Ceiling Tile
AWS	Acoustical Wall Systems
B	Base
C	Carpet
CAB	Residential Cabinet
CG	Corner Guard
CONC-P	Concrete, Polished
CONC-S	Concrete, Sealed
CONC-ST	Concrete, Stained
CT	Carpet Tile
CWV	Concrete Wall Veneer
DF	Drapery Fabric
DGL	Decorative Glass
DGF	Decorative Glass Flim
DM	Decorative Metal
F	Fabric
FS	Acoustical Stretched Fabric Ceiling
FRP	Fiberglass Reinforced Panels
G	Grout
HR	Handrail
HW	Hardware
P	Paint
PCON	Pre-cast Concrete
PL	Plastic Laminate
Q	Quartz Solid Surfacing
RAF	Resilient Athletic Flooring
RB	Resilient Base
RFS	Resilient Flooring Sheet
RFT	Resilient Flooring Tile or Plank
RS	Roller Shade
SB	Stretch Barre
SST	Stainless Steel
ST	Stone Slab
T	Tile
WC	Wall Covering
WD	Wood
WDC	Wood Countertop
WP	Wall Protection Paneling
WVP	Wood Veneer Paneling

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

CONC-S Concrete, Sealed

SECTION 03 35 16 - SPECIAL CONCRETE FLOOR FINISHING

CONC-P Concrete, Polished
Sheen: Semi-Gloss
Texture: 16 Micro Inches

SECTION 03 49 00 - GLASS FIBER REINFORCED CONCRETE

CWV-1 Manufacturer: 2Stone
Product: Lightweight Fiber Reinforced Concrete Veneer
Style: Board Form
Color: Standard grey - 100% impregnated pigment
Size: 72" x 6" x 1/2" (length tolerance +/- 1/4")
Weight: +/- 4 LBS/SF
Joints: Offset
Corners: Mitered
Flame Resistance: Contains no combustible material or components
Contact: Lise Brown, <lise@2stone.ca>

SECTION 05 52 13 - PIPE AND TUBE RAIL

METAL HANDRAIL

HR-2 Manufacturer: Promenaid
Product: Extruded Aluminum Handrail
Handrail Finish: Satin Black
Hardware Finish: Satin Black
Endcap Style: ADA Return
Bracket Style: Pivoting
Diameter: 1.6" (4 cm)
Length: Per Drawings, Verify in Field

DIVISION 06

WOOD

WD-1 Manufacturer: Sustainable Northwest Wood
Species: Oregon White Oak
Cut: Rift
Finish: Clear, satin

Contact: Terry Campbell <terry@snwood.com>

WD-2

Product: Apple Ply
Species: Baltic Birch
Finish: Clear, satin

WD-3

Species: Paint Grade
Color: P-8
Finish: Semi-Gloss

WD-4

NOT USED

WD-5

Amenity Building Wood Plank Ceiling
Manufacturer: Sustainable Northwest Wood
Species: Oregon White Oak – Character Grade
Style: Tongue and Groove
Plank Size: 5"W, Length varies 8' - 12'
Thickness: 5/8"
Edge: V Groove
Factory Finish: Clear, 10% sheen, Class A
Contact: Terry Campbell <terry@snwood.com>

WD-5 ALT

Amenity Building Wood Plank Ceiling
Manufacturer: Zena Forest Products
Species: Oregon White Oak – Select Grade, Unfinished
Style: Tongue and Groove, End-matched
Plank Size: 4.25"W, Length varies 2' - 8'
Thickness: 3/8" Engineered
Edge: Micro Bevel
Field Finish: Clear, 10% sheen, Class A
Contact: Shannon Wanamaker <shannon@zenaforest.com>

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

BASE

B-1

Species: White Oak
Cut: Rift
Finish: Clear, satin
Size: 1x4
Notes: Solid wood, Only located at WD-1 wall treatment or casework. Refer to interior details.

B-2

Species: MDF
Finish: Painted, Semi-Gloss (color varies, see room finish schedule)

Size: 1x4
Note: Only located at accent wall treatment or casework. Refer to interior details.

B-101 Species: MDF
 Finish: P-101
 Size: 1x4

B-102 Species: Paint-Grade Wood
 Finish: P-101
 Size: 1x4
 Notes: Wet Locations, all sides of wood to be painted

WOOD HANDRAIL

HR-1 Manufacturer: N/A
 Species: Paint-Grade Wood
 Profile: 1.25" Dia. Round
 Finish: P-8, Semi-Gloss
 Bracket Finish: Black

STRETCH BARRE

SB-1 Manufacturer: CustomBarres.com
 Product: Sissone Single Wall Mount System
 Barre Profile: 1 5/8" Dia. Round, Oak finish
 Bracket: Closed Saddle, 4 mounting holes, Black finish

SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

DECORATIVE METAL

DM-1 Manufacturer: N/A
 Material: Stainless Steel Sheet
 Gauge: 16
 Finish: Black Powdercoat to match Cardinal Paint Powdercoat C241-BK109,
 Black Fine Texture S/G

DM-2 Manufacturer: Banker Wire
 Product: Mid-Fill Woven Wire Mesh
 Pattern: M22-22
 Material: Steel
 Secondary Finish: Black Powdercoat to match Cardinal Paint Powdercoat C241-
 BK109, Black Fine Texture S/G
 Panel Size: Per Drawings

Frame: U Channel, finish to match wire mesh
Contact: Harrison Horan <hhoran@bankerwire.com>

DM-3 Manufacturer: N/A
 Material: Stainless Steel 1/2" outside diameter rods
 Gauge: 16
 Finish: Black Powdercoat to match Cardinal Paint Powdercoat C241-BK109,
 Black Fine Texture S/G

PLASTIC LAMINATE

PL-1 Manufacturer: Arpa
 Pattern: 4367 Rovere Rhone
 Finish: Larix

PL-2 Manufacturer: Formica
 Pattern: Manitoba Maple 7911-60
 Finish: Matte

PL-3 Manufacturer: Arborite
 Pattern: Inukshuk Carbon P-346 CA
 Finish: Cashmere

PL-4 Manufacturer: Arborite
 Pattern: Inukshuk Taupe P-345 CA
 Finish: Cashmere

WOOD See control sample listed within Division 6

FABRIC

F-1 Manufacturer: Concertex
 Pattern: Nappa
 Color: Safari
 Content: 100% Silicone, Inherently Graffiti-Free
 Backing: 100% Polyester
 Width: 54"
 Repeat: N/A
 Railroaded: N/A
 Flammability: CA Bulletin 117-2013, UFAC/NFPA 260
 Contact: Crystal Davis <crystalsdnw@gmail.com>

CABINET HARDWARE

HW-1 For use with Wood Casework
 Manufacturer: DesignPerfect

Style: Sleek Square Bar Cabinet Pull
Finish: Champagne Bronze/Gold
Size: 128mm CC

HW-2 For use with Plastic Laminate Casework
Manufacturer: DesignPerfect
Style: Sleek Square Bar Cabinet Pull
Finish: Black
Size: 128mm CC

SECTION 06 42 16 - WOOD VENEER PANELING

WVP-1 Match WD-1
Note: Provide Fire Rated Class A Substrate, TYP.

SECTION 06 82 05 - FIBERGLASS REINFORCED PLASTIC PANELING

FRP-1 Manufacturer: Marlite
Product: Standard FRP
Color: White P100
Texture: Pebble
Fire Rating: Class C (Class A available)

FRP-2 Manufacturer: Marlite
Product: Induro HPL-Faced FRP
HPL Face: Arborite Inukshuk Carbon P-346
Fire Rating: Class C (Class A available)

FRP-3 Manufacturer: Marlite
Product: Induro HPL-Faced FRP
HPL Face: Wilsonart Manitoba Maple 7911-60
Fire Rating: Class C (Class A available)

SECTION 08 80 00 - GLAZING

DGL-1 Manufacturer: N/A
Style: Clear Tempered Glass
Thickness: Per Interior Details

DECORATIVE GLAZING FILM

DGF-1 Manufacturer: Solyx
Style: SX-3140 Dusted Crystal

SECTION 08 83 00 – MIRRORS not defined in 09 06 02; refer to individual specification sections

SECTION 09 30 00 – TILING

- T-1 Floor Tile
 Manufacturer: Arizona Tile
 Style: Ardesia
 Color: Grey
 Size: 24x48
 Thickness: 10mm
 Finish: Matte
 Contact: Jen Stone <JStone@arizonatile.com>
 Grout: Laticrete Sterling Silver 78
 Grout Joint Width: 1/8"
 Installation Method: Stacked
 DCOF Rating: ANSI A137.1/ANSI 326.3, Dynamic Wet >0.42
- T-2 Wall Tile
 Manufacturer: United Tile
 Product: Mirazur by Sonoma Tilemakers
 Style/Color: Urso
 Finish: Crackle
 Size: 5-1/8 x 4-1/2 Prado Field
 Thickness: 3/8"
 Contact: Charlene Kuhn <Charlene@UnitedTile.com>
 Grout: Laticrete Dusty Gray 60
 Note: Crackle Glaze must be sealed
- T-3 Floor Tile
 Manufacturer: Arizona Tile
 Style: Ardesia
 Color: Grey
 Size: 12x24
 Thickness: 10mm
 Finish: Matte
 Contact: Jen Stone <JStone@arizonatile.com>
 Grout: Laticrete Sterling Silver 78
 Grout Joint Width: 1/8"
 Installation Method: 1/3 offset
 DCOF Rating: ANSI A137.1/ANSI 326.3, Dynamic Wet >0.42
- T-4 Wall Tile
 Manufacturer: United Tile

Style: Tribeca by Equipe
Colors: Gypsum White
Finish: Gloss
Size: 2.5" x 10"
Thickness: 9mm
Contact: Charlene Kuhn <Charlene@UnitedTile.com>
Grout: Latricrete Dusty Gray 60
Grout Joint Width: 1/8"
Decorative Trim: Schluter DesignLine, Black Finish

T-5 NOT USED

T-6 Wall Tile
Manufacturer: Tile Bar
Style: Stacy Garcia Artblock Fluted
Color: Bianco
Size: 4" x 16"
Thickness: 10mm
Finish: Glossy
Contact: Lois Wallace <lwallace@tilebar.com>
Grout: Latricrete Dusty Gray 60
Grout Joint Width: 1/8"

T-7 Wall Tile
Manufacturer: United Tile
Style: St. Martin by Portobello
Color: Sand
Size: 12" x 24"
Total Thickness: 9mm
Finish: Matte
Contact: Charlene Kuhn <Charlene@UnitedTile.com>
Grout: Laticrete Marble Beige 17
Grout Joint Width: 1/8"
Installation Method: 1/3 offset

T-8 Wall Tile
Manufacturer: United Tile
Style: Country by Equipe
Colors: Blanco (T-8a) Gris Claro (T-8b), Ivory (T-8c), Grey Pearl (T-8d)
Note: Install equal percentage of all colors installed in random mix
Size: 2-1/2 x 8"
Total Thickness: 9.5mm
Finish: Gloss
Contact: Charlene Kuhn <Charlene@UnitedTile.com>
Grout: Laticrete Marble Beige 17
Grout Joint Width: 1/8"

Installation Method: Stacked

T-101 Light and Dark Schemes
Wall Tile
Manufacturer: Emser
Style: Catch
Color: Fawn
Size: 3"x12"
Thickness: 7.6mm
Finish: Glossy
Contact: Rachel Pratt <RachelPratt@emser.com>
Grout: Latricrete Hemp 27
Grout Joint Width: 1/8"

SECTION 09 51 00 - ACOUSTICAL CEILINGS

ACT-1 Manufacturer: Armstrong Ceilings
Product: Tectum Finale
Style: Flat Panel
Edge Profile: Long edge bevel, short edge square
Size: 23-3/4 x 96 x 1
Total Panel Thickness: 1" Finale with integral minwool inset and 1" furring
Color: Natural
Contact: Dianne S. Knight <DSKnight@armstrongceilings.com>
UL Classified Flame Spread: ASTM E 1264; Class A

ACT-2 Manufacturer: Armstrong Ceilings
Product: Metalworks Mesh
Style: Lattice Expanded Metal Square Lay-in
Suspension System: 15/16" 360-degree Painted Grid
Size: 24" x 48" x 1/4"
Color: Custom color to match Sherwin Williams Midday SW 6695
Contact: Dianne S. Knight <DSKnight@armstrongceilings.com>
Fire Performance: Non-combustible

SECTION 09 65 00 - RESILIENT FLOORING

RESILIENT FLOORING SHEET

RFS-1 Manufacturer: Interface
Product: Heterogeneous Vinyl Sheet
Style: Meshed
Color: Taupe A03002
Thickness: 2.5mm

Roll Width: 6'
Welding Rod: To Match
Slip Resistance: (ASTM D2047) >0.55 wet/dry, ADA Compliant
Radiant Flux: (ASTM E648) Class I

RESILIENT FLOORING TILE

- RFT-1 Manufacturer: Patcraft
 Product: LVT
 Style: Inset I577V
 Color: Iron Silver
 Thickness: 5mm
 Size: 18" x 36"
 Wear Layer: 20 mil
 Edge: Square
 Installation: Glue Down
 Installation Method: Monolithic
 Contact: Amanda Dammarell <amanda.dammarell@patcraft.com>
 Radiant Panel / ASTM E648: Class I
 Slip Resistance / ASTM D2047: >0.5, meets the recommended static coefficient
 of friction for ADA Walking Surfaces
- RFT-101 Light and Dark Schemes
 Manufacturer: Evoke Commercial
 Product: Anchor
 Color: Sterling 45249
 Thickness: 2mm
 Size: 7" x 48"
 Wear Layer: 12 mil
 Contact: Richard Brotherton, richardb@metrofloors.com

RESILIENT BASE

- RB-1 Manufacturer: Roppe
 Style: Contours
 Profile: Candid #60
 Size: 4 1/2" x 3/8"
 Color: Black
- RB-2 Manufacturer: Roppe
 Style: Q6 QuickSix
 Profile: Cove Toe Base
 Size: 4" x 1/8" x 120' roll
 Color: Black

SECTION 09 65 66 – RESILIENT ATHLETIC FLOORING

- RAF-1 Manufacturer: Roppe
Style: Tuflex Recycled Rubber Tile
Color: 982 Taupe
Size: 27" x 27"
Edge: Square
Thickness: 3/8"
ASTM E648 (NFPA 253) - Critical Radiant Flux Class 1
ASTM E662 (NFPA 258) - Smoke Density Passes, ≤ 450
ASTM D2047 - Static Coefficient of Friction ≥ 0.50
- RAF-2 Manufacturer: Eco Surfaces
Style: Forest Rx
Color: Toasted Oak 9822
Thickness: 7mm / .28"
Roll Width: 6'
Construction: Heterogeneous Sheet
Behavior to fire: ASTM E648 Class 1
Coefficient of Friction: ASTM D2047 Static ≥ 0.6

SECTION 09 68 00 – CARPETING

CARPET

- C-1 Manufacturer: Mannington
Collection: Glitch Art
Style: Circuit
Color: Screen Burn
Width: 12'-6"
Weight: 20 oz.
Pattern Repeat: 18 3/4" W x 19 1/2"L
Dye Method: 100% Solution Dyed
Backing: Integra HP
Installation: Direct Glue
Contact: Susan Revak <Susan.Revak@mannington.com>
Radiant Panel (ASTM E648): Passes – Class I
Smoke Density (ASTM E662): Passes ≤ 450

SECTION 09 68 13 – TILE CARPETING

- CT-1 Manufacturer: Patcraft
Collection: Deconstructed Metal
Style: Alloy Shimmer I0421

Color: 00520 Nickel Bronze
Size: 12"x48"
Dye Method: 100% Solution Dyed
Primary Backing: Non-woven Synthetic
Secondary Backing: Ecoworx Tile
Installation: Brick
Contact: Amanda Dammarell <amanda.dammarell@patcraft.com>
Radiant Panel: Class I
NBS Smoke: Less than 450

CT-2 Manufacturer: Mannington
Collection: Swell
Style: Hightide
Color: Port
Size: 18" x 36"
Dye Method: 100% Solution Dyed
Backing: Infinity 2
Installation: Horizontal Brick Ashlar
Contact: Susan Revak <Susan.Revak@mannington.com>
Radiant Panel (ASTM E648): Passes – Class I
Smoke Density (ASTM E662): Passes ≤ 450

CT-3 Manufacturer: Interface
Collection: Rising Signs
Style: Angle Up
Color: Selenium 107206
Size: 9.8" x 39.3" (25cm x 1m)
Dye Method: 100% Solution Dyed
Backing: GlasBac
Installation: Ashlar
Contact: Karen Gilroy <Karen.Gilroy@interface.com>
Flooring Radiant Panel (ASTM E-648): Passes
Smoke Density (ASTM E-662): ≤ 450
Flammability: Passes Methenamine Pill Test (DOC-FF1-70)

CT-4 Manufacturer: Mannington
Collection: Swell
Style: Colorcast
Color: Seabed
Size: 18" x 36"
Dye Method: 100% Solution Dyed
Backing: Infinity 2
Installation: Horizontal Brick Ashlar
Contact: Susan Revak <Susan.Revak@mannington.com>
Radiant Panel (ASTM E648): Passes – Class I
Smoke Density (ASTM E662): Passes ≤ 450

CT-5 Manufacturer: Patcraft
 Collection: Beyond the Door
 Style: Paseo IO316
 Color: Obsidian 00595
 Size: 24"x24"
 Dye Method: 100% Solution Dyed
 Primary Backing: Non-woven Synthetic
 Secondary Backing: Ecoworx Tile
 Installation: Ashlar
 Contact: Amanda Dammarell <amanda.dammarell@patcraft.com>
 Radiant Panel: Class I
 NBS Smoke: Less than 450

SECTION 09 72 00 - WALL COVERINGS

WC-1 Manufacturer: Momentum
 Style: Avenue
 Color: Midnight MAG1142
 Type II
 Width: 54"
 Content: Vinyl
 Repeat: 5.05" Repeat, Straight Non- Reversible
 Fire Rating: Class A
 Contact: Suzanne Alley <salley@momtex.com>

WC-2 Manufacturer: Momentum
 Style: Astoria
 Color: Prairie A977-512
 Type II
 Width: 54"
 Content: Vinyl
 Repeat: N/A
 Fire Rating: Class A
 Contact: Suzanne Alley <salley@momtex.com>

WC-3 Manufacturer: Astek
 Style: Marley
 Color: Black and White
 SKU: 2773-934601
 Type II
 Width: 20.5"
 Content: Vinyl
 Repeat: 23.6"V
 Fire Rating: Class A

Contact: Jeff Dey <jeff@astek.com>

- WC-4 Manufacturer: Wolf Gordon
 Style: Plaster Prelude
 Color: Pebble Pitch
 SKU: GOH 33215903
 Material: Type II Vinyl
 Width: 54"
 Fire Rating: Class A; NFPA 286
 Contact: Ginny Combs, <ginny.combs@wolfgordon.com>
- WC-5 Building 2 Lobby
 Manufacturer: Designtex
 Product: Custom Large-Scale Vinyl Graphic Wallcovering
 Substrate: Type II, Smooth
 Image: Large format image purchased from Shutterstock or SIM
 Size: per drawings (must be field verified before production material)
 Flame Resistance: ASTM E84 Class A
 Contact: McPherson, Jenna <JMcPherson@designtex.com>
- WC-6 Building 2 Zen Space
 Manufacturer: Designtex
 Product: Custom Large-Scale Vinyl Graphic Wallcovering
 Substrate: Type II, Smooth
 Image: Large format image purchased from Shutterstock or SIM
 Size: per drawings (must be field verified before production material)
 Flame Resistance: ASTM E84 Class A
 Contact: McPherson, Jenna <JMcPherson@designtex.com>
- WC-7 Dog / All Wash
 Manufacturer: Olivia + Poppy
 Style: Dog Days
 Color: Black and White
 Material: Type II Vinyl
 Width: 25"
 Repeat: 25" x 25"
 Fire Rating: Class A
- WC-8 Maker Space
 Manufacturer: Designtex
 Product: Custom Large-Scale Vinyl Graphic Wallcovering
 Substrate: Type II, Smooth
 Image: Large format image purchased from Shutterstock or SIM
 Size: per drawings (must be field verified before production material)
 Flame Resistance: ASTM E84 Class A
 Contact: McPherson, Jenna <JMcPherson@designtex.com>

- WC-9 Manufacturer: Aino
 Style: Floralish XL ECO 052214
 Color: Custom
 Material: Type II PVC-Free Terralon
 Width: 51"
 Fire Rating: Class A, Passes ASTM E84
 Contact: 702.493.4554
- WC-10 Manufacturer: Tri-kes / Source One
 Product: Acousticord Acoustic Wallcovering
 Color: ASC-06 Caramel
 Width: 79"
 Thickness: .2" (.5cm)
 Fire Rating: Class A
 Contact: Suzanne Alley <salley@momtex.com>
- WC-11 Building 1 Elevator Lobby Entry
 Manufacturer: Look Walls
 Collection: Pattern Play
 Style: Playhouse PP007-01 Multi
 Substrate: Type II, Look Linen
 Width: 54"
 Size: per drawings (must be field verified before production material)
 Fire Rating: Class A, ASTM E-84
 Contact: Amy Tullis Fricke <amy@agencyetoile.com>

SECTION 09 84 11 - ACOUSTICAL WALL PANELS

- AWS-1 Manufacturer: Acoufelt
 Product: Pixel Acoustic Tiles
 Color: Denim + Popcorn (DE09 - field + PO26 - dots)
 Composition: 100% Polyester
 Material: FilaSorb
 Thickness: 24mm / .94" (+/- 10%)
 Dimensions: 48"W x 109.71"H
 Fire Rating: Class A
 Contact: Sabrina Truan, (248) 829-9961, <sabrina.truan@acoufelt.com>
- AWS-2 Manufacturer: Filzfelt
 Product: Aro Plank 1
 Color: 427 Stein
 Content: Wool Felt and Acoustic Substrate
 Width: Varies by Plank
 A: 4 1/4"

B: 2 1/4"
C: 6 1/4"
D: 8 1/4"
E: 10 1/4"
F: 1'-0 1/4"

Max Plank Length: 9'-0"

Repeat: 14'-7" W

Installation Method: Aro Plank 1.4 (DFBEAECBACADACFBCAECBACADACD)

Fire Rating: Class A

Contact: Christine Johnson <cjohnson@spinneybeck.com>

AWS-3

Manufacturer: Acoufelt

Product: Solid Acoustic Panels

Color: Gray GR02

Composition: 100% Polyester

Material: FilaSorb

Thickness: 7mm / 1/4"

Dimensions: 48"W x 110"H

Fire Rating: Class A

Contact: Sabrina Truan, (248) 829-9961, <sabrina.truan@acoufelt.com>

SECTION 09 91 23 - INTERIOR PAINTING

PAINT FINISH

- P-1 GENERAL
Manufacturer: Sherwin Williams
Color: Origami White SW 7636
Sheen: Varies by location
- P-2 Corridor Ceiling and accent
Manufacturer: Sherwin Williams
Color: Gauntlet Gray SW 7019
Sheen: Varies by Location
- P-3 Manufacturer: Sherwin Williams
Color: Iron Ore SW 7069
Sheen: Varies by location
- P-4 Manufacturer: Sherwin Williams
Color: Gallery Green SW 0015
Sheen: Eggshell
- P-5 Manufacturer: Sherwin Williams
Color: Silken Peacock SW 9059

Sheen: Eggshell

- P-6 Accent
 Manufacturer: Sherwin Williams
 Color: Midday SW 6695
 Sheen: Eggshell
- P-7 Manufacturer: Sherwin Williams
 Color: Repose Gray SW 7015
 Sheen: Eggshell
- P-8 Manufacturer: Sherwin Williams
 Color: Tricorn Black SW 6258
 Sheen: Eggshell
- P-9 Manufacturer: Sherwin Williams
 Color: Accessible Beige SW 7036
 Sheen: Flat
- P-101 Unit General
 Manufacturer: Sherwin Williams
 Color: Pure White SW 7005
 Sheen: Eggshell at Walls, Semi-Gloss at Trim and Doors, Flat at Ceiling

SECTION 10 26 01 - WALL AND CORNER GUARDS

CORNER GUARD

- CG-1 Manufacturer: Inpro
 Material: PVC
 Color: TBD - To match wall finish
 Wing Size: 3/4"
 Height: 48"
 Mounting Style: Heavy duty adhesive

SECTION 10 31 00 - MANUFACTURED FIREPLACES

PRE-CAST CONCRETE HEARTH

- PCON-1 Manufacturer: Cement Elegance
 Product: NatureCast Concrete
 Color: Cobblestone
 Contact: Bayard Fox <bayard@cementelegance.com>

SECTION 12 24 13 – ROLLER SHADES

RS-1 Manufacturer: SWF Contract
Model: True Performance
Installation: Inside Mount
Shadecloth: Mermet E Screen Series
Color: TBD
Transparency: 3%
Operation: Manual
Facia: White, 4”H
Fire Classification: NFPA 701-19 TM#1

RS-101 Manufacturer: SWF Contract
Model: True Performance
Installation: Inside Mount
Shadecloth: Mermet E Screen Series
Color: TBD
Transparency: 1%
Operation: Manual
Facia: White, 4”H
Fire Classification: NFPA 701-19 TM#1

SECTION 12 35 30 – RESIDENTIAL CASEWORK

CAB-101 Light Scheme
Manufacturer: Lanz
Style: Woodgrain TFL
Color: Bleached Legno
Lower Hardware: 106mm (4.17”W) Tab Pull, Black Finish
Upper Hardware: Hardware: 75mm (2.95”W) Tab Pull, Black Finish

CAB-102 Dark Scheme Lower & Floating Shelves above sink
Manufacturer: Lanz
Style: Woodgrain TFL
Color: Bleached Legno
Hardware: 106mm (4.17”W) Tab Pull, Black Finish

CAB-103 Dark Scheme Upper
Manufacturer: Lanz
Style: Solid TFL
Color: White
Hardware: 75mm (2.95”W) Tab Pull, Black Finish

SECTION 12 36 00 – COUNTERTOPS

PLASTIC LAMINATE

PL-11 Manufacturer: Wilsonart
 Pattern: Black 1595-60
 Finish: Matte

PL-12 REFER TO PL-4

PL-13 REFER TO PL-3

QUARTZ SOLID SURFACE

Q-1 Manufacturer: Caesarstone
 Pattern: Cosmopolitan White 5130
 Finish: Polished
 Thickness 2cm
 Edge: square, built-up

Q-2 Manufacturer: Arizona Tile / Della Terra Quartz
 Pattern: Aerial
 Finish: Polished
 Thickness 2cm
 Edge: square, built-up

Q-3 Manufacturer: Caesarstone
 Pattern: Raven 4120
 Finish: Polished
 Thickness 2cm
 Edge: square, built-up

Q-4 Manufacturer: Caesarstone
 Pattern: Sleek Concrete 4003
 Finish: Polished
 Thickness 2cm
 Edge: square, built-up

Q-101 Light Scheme
 Manufacturer: Daltile
 Product: One Quartz
 Color: Golden Gate
 Finish: Polished
 Thickness/Edge: 2cm, Eased edge
 Contact: Jeff Lang <jeff.lang@daltile.com>

Q-102 Dark Scheme
 Manufacturer: Daltile
 Product: One Quartz
 Color: Broadway Black
 Finish: Polished
 Thickness/Edge: 2cm, Eased edge
 Contact: Jeff Lang <jeff.lang@daltile.com>

END OF SECTION

**SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Flat Drywall Suspensions Systems.
- D. Resilient sound isolation clips.
- E. Shaft wall system.
- F. Acoustical Insulation.
- G. Gypsum wallboard.
- H. Glass mat faced gypsum board.
- I. Joint treatment and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- 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 A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process 2022a.
- D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- E. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- F. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products 2019.
- G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- H. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- K. 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.
- L. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members 2018, with Editorial Revision.
- M. 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.

- N. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- O. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- P. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- Q. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
- R. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets 2017.
- S. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2022.
- T. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- U. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections; 2018.
- V. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).
- W. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- X. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- Y. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- Z. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- AA. ASTM E413 - Classification for Rating Sound Insulation 2022.
- BB. GA-216 - Application and Finishing of Gypsum Panel Products 2021.
- CC. GA-600 - Fire Resistance and Sound Control Design Manual 2021.
- DD. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- EE. UL (FRD) - Fire Resistance Directory Current Edition.
- FF. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- GG. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- HH. NWCB GWB-2 - Northwest Wall and Ceiling Bureau; Finishing and judging of gypsum wallboard
- II. NWCB GWB-3 - Northwest Wall and Ceiling Bureau; Recommendations for gypsum wallboard finishes.
- JJ. NWCB GWB-4 - Northwest Wall and Ceiling Bureau; Installation of control joints.
- KK. NWCB FR-3 - Northwest Wall and Ceiling Bureau; Installing resilient channels.
- LL. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 PERFORMANCE REQUIREMENTS

- A. Wall Deflection: Not to exceed L/360 of wall height.

- B. Interior Partitions: Construct component parts so completed partition will withstand minimum 5 pounds per square foot inward and outward pressure normal to wall plane.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
- C. 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.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.

1.05 MOCK-UPS

- A. Provide a mock-up gypsum board assembly of assembly type selected by Architect.
 - 1. Provide one mock-up panel for each gypsum board finish used in Work.
 - 2. Minimum panel width 8 feet wide by full height of partition.
 - 3. Revise as necessary to secure Architect's approval.
 - 4. Approved mock-ups may be incorporated into finished Work.
- B. Locate where directed.
- C. Mock-up, when approved by Architect, to be used as datum points for comparison with remainder of Work of this Section for purpose of acceptance or rejection.
- D. Mock-up may remain as part of the Work.

1.06 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with listing source for fire-rated assemblies.
- B. Metal Framing Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
 - 1. Member of Steel Stud Manufacturers Association (SSMA).
 - 2. SSMA Certification Label: Provide label that manufacturing facilities satisfy the SSMA program certification requirements.
- C. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

1.07 REGULATORY REQUIREMENTS

- A. For fire-resistant rated partitions, construct gypsum board assemblies in accordance with design designation listing of testing agency indicated, or otherwise acceptable to governing authority,

to obtain designated rating.

1. Assemblies indicated on the drawings as Generic (G) shall be constructed with components by any manufacturer specified.
 2. Assemblies indicated on the drawings as Proprietary (P) shall be constructed with components by the manufacturer listed in the tested assembly, whether indicated in these specifications or not. When multiple manufacturers are included in the listing source, those also included in these specifications are to be used.
- B. Line blockouts in walls for recessed toilet accessories, fire extinguisher cabinets, and the like, with gypsum board as necessary to preserve fire-resistive rating of partition.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer, with labels identifying fire-resistance rating and water resistance.
- B. Store gypsum panels flat in a manner to prevent sagging.
- C. Do not overload floor decks with concentrated accumulation of materials.
- D. Store above ground, under cover and protected from damage.

1.09 FIELD CONDITIONS

- A. Maintain between 55 degrees F and 75 degrees F for 24 hours before installation, during installation, and for 24 hours after materials have dried.
- B. Maintain at least 30 foot candles of illumination measured 3 feet above floor in Work spaces during joint treatment.
- C. Maintain sufficient ventilation for proper joint treatment drying.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 1. See PART 3 for finishing requirements.
- B. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 1. Air Pressure Within Shaft: Sustained loads of 7.5 lbf/sq ft with maximum mid-span deflection of L/360.
- C. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
 1. Air Pressure Within Shaft: Sustained loads of 7.5 lbf/sq ft with maximum mid-span deflection of L/360.
 2. Acoustic Attenuation: STC of 60 - 65 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
 2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.

3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 1. ClarkDietrich: www.clarkdietrich.com/#sle.
 2. Marino: www.marinoware.com.
 3. Cemco; www.cemcosteel.com.
 4. Fire Track Corp: www.firetrak.com.
 5. Pliteq Inc.; www.pliteq.com.
 6. Kinetics Noise Control; www.kineticsnoise.com.
 7. Steeler: www.steeler.com
 8. Scafco Steel Stud Manufacturing Co: www.scafco.com
 9. The Steel Network, Inc: www.SteelNetwork.com.
 10. United States Gypsum Co: www.usg.com.
- B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/360 at 5 psf.
 1. Studs in partitions with tile finish: 20 gauge.
 2. Studs adjacent to door jambs, behind grab bars and handrails: 18 gauge.
 3. Type RC-1: Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one leg only.
 - a. Thickness: 22 mil (0.022 inch), corrosion resistant steel per ASTM A653/A653M, G40 for interior walls or ceilings.
 - b. Size: 1/2 by 2-5/8 inch.
 - c. Products:
 - 1) ClarkDietrich; RC Deluxe Resilient Channel: www.clarkdietrich.com.
 - 2) Cemco; RC1-XD (Xtra-Duty): www.cemcosteel.com.
 - d. Manufacturer's standard hot-dip galvanized coating per ASTM A653/A653M.
 - 1) G 185 hot-dip galvanized coating for exterior soffits.
 4. Resilient Sound Isolation Clips: Steel resilient clips with molded rubber isolators. Installed in conjunction with metal hat channel to isolate gypsum wallboard materials from structural substrate.
 - a. Manufacturer: Type RSIC-1.
 - 1) Basis of Design: PAC International; RSIC-1: www.pac-intl.com
 - 2) Pliteq Inc.; GenieClip RST: www.pliteq.com.
 - 3) Kinetics Noise Control; IsoMax www.kineticsnoise.com.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Resilient Isolation Clip:
 - 1) Finish: Corrosion resistant steel per ASTM A653/A653M, G40.
 - 2) Thickness: 18 gauge.
 - c. Drywall Furring Channel: Hat shaped.
 - 1) Thickness: 25 gauge.
 - 2) Size:
 - (a) Width: 2-9/16 to 2-11/16 inch.

- (b) Depth: 7/8 inch.
- d. Tie Wire: 18 gauge, annealed, galvanized steel.
- e. Fasteners: Type recommended by manufacturer for application.
- 5. Z-Furring Members:
 - a. Thickness: 25 gauge, corrosion resistant steel per ASTM A653/A653M, G185 for conditions outside weather barrier.
 - b. Depth: As indicated in Drawings.
 - c. Face Flange: 1-1/4 inch.
 - d. Wall Attachment Flange: 7/8 inch.
- 6. Blocking, Steel Flat Strap and Backing Plate:
 - a. Corrosion resistant steel per ASTM A653/A653M, length as indicated, or required to suit application.
 - b. Size: 16 gauge by 10 inches wide, unless otherwise indicated.
 - c. Specifically, provide the following non-structural 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) Wall-mounted bike racks.
 - 8) Chalkboards and marker boards.
 - 9) Wall paneling and trim.
 - 10) Joints of rigid wall coverings that occur between studs.
- C. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 40 00.
- D. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
 - 1. Structural Performance Characteristics:
 - a. Provide gypsum board shaft-wall assemblies capable of withstanding full air-pressure loads indicated for maximum heights of partitions indicated without failing and while maintaining an airtight and smoke-tight seal.
 - b. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing runners to bend or to shear and studs to become crippled.
 - c. Provide gypsum board shaft-wall assemblies for horizontal duct enclosures capable of spanning distances indicated within deflection limits indicated.
- E. Flat Drywall Suspensions Systems:
 - 1. Manufacturers:
 - a. Armstrong World Industries, Inc; Product ShortSpan DGS System: www.armstrong.com.
 - b. United States Gypsum Co. Product: Flat Drywall Suspensions System: www.usg.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Main Tees: Fire-Rated Heavy Duty classification 1-1/2 inch high x 144 inch long, integral reversible splice with knurled face.

- a. Straight Main Tee: 15/16 inch Face
3. Cross Members: Fire-Rated members with knurled face.
 - a. Cross Tees: 1-1/2 inch high x 48 inch long with 1-1/2 inch wide face. Tees must have quick release cross tee ends to provide positive locking and removability without the need for tools.
4. Accessory Cross Tees: Cross tees must have knurled faces. Cross tees have quick release cross tee ends to provide positive locking and removability without the need for tools.
 - a. Fire-Rated 1-1/2 inch high x 24 inch long with 15/16 inch face
 - b. Non Fire-Rated 1-1/2 inch high x 96 inch long with 15/16 inch face
5. Wall moldings: Single web with knurled face.
 - a. 1 inch x 1-1/2 inch x 144 inch long wall molding.
 - b. 144 inch x 1-9/16 inch x 1 inch x 1 inch channel molding.
6. Accessories:
 - a. Transition Clip, type recommended by manufacturer for system.
 - b. Splice Clip, type recommended by manufacturer for system.
- F. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and secured with deflection clips or screws each side of stud.
 1. Deflection Clip Manufacturer:
 - a. Deep Leg Slotted Track (SDLT) by SCAFCO Steel Stud Manufacturing Co.; www.scafco.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Non-structural Framing Accessories:
 1. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
 - b. Height: As indicated on drawings.
 - c. Products:
 - 1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.

2.03 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.
 7. BPB America : www.bpb-na.com.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

- a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 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; EagleRoc Regular Gypsum Wallboard and FireBloc Type X Gypsum Wallboard.
 - b. CertainTeed Corporation; ProRoc Brand Gypsum Board Type X.
 - c. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
 - d. National Gypsum Company; Gold Bond Brand Gypsum Wallboard Type X.
 - e. USG Corporation; Sheetrock Brand Gypsum Panels Type X.
- C. Moisture Resistant Gypsum Board: One of the following products:
 1. Application: Surfaces which are in moisture atmospheres but will not be wet including: restrooms, bathrooms, showers.
 2. Moisture resistant gypsum core with paper facing in accordance with ASTM C1396/C1396M.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 4. Water absorption not greater than 5 percent by weight after two hours immersion in accordance with ASTM C473.
 - a. Thickness: 5/8 inch.
 - b. Products:
 - 1) Georgia Pacific; Products; ToughRock Mold Guard; www.buildgp.com.
 - 2) National Gypsum Company; Gold Bond XP: www.nationalgypsum.com.
 - 3) USG Corporation; Mold Tough Panels: www.usg.com.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- D. Shear Wall Sheathing: Gypsum board and sheet steel composite panel.
 1. Gauge for framing and attachment of Shear Wall Sheathing to provide shear capacity in accordance with IAPMO-ES, ER-0126 and to the specific project and Seismic Zone or Wind Zone location.
 2. Fire Resistance: ASTM E84, Class A1; zero flame spread and zero smoke developed.
 3. Galvanized Steel:
 - a. No.2 2 gauge 0.027 inch base-metal thickness minimum per ASTM A653/A653M CS Grade 33/hot dipped galvanized G40 minimum per ASTM A924/A924M.
 4. Gypsum board to comply with ASTM C1177/C1177M, ASTM C1325, ASTM C1278/C1278M or ASTM C1288 depending on application.
 5. Steel Framing Fasteners: Secure using the following:
 - a. Series 200/200S:
 - 1) Self-drilling/self-tapping pilot point flat head screws, #8 minimum diameter 0.138-inch, with a minimum 0.3145-inch head diameter, 1.5-inch long, and a 3/8-inch minimum drill tip, complying with SAE J78, ASTM C1513 and ASTM C954. ESR-1271 by John Grabber & Assoc.
 - b. Series 200S:

- 1) #8 X 1-5/8-inch long. Winged Driller Grabber Super Drive LOX drive screws or equal. See ICC-ES Report ESR-1271.
- c. Series 200W :
 - 1) #10 X 3/4-inch minimum self-drilling/self-tapping pan-head screws.
6. Wood Framing: Secure using the following:
 - a. Series 200 Structural Panels: #8 X 2-inch minimum wood screws.
 - b. Series 200W Structural Panels: 10d X 1 1/4-inch minimum smooth plywood nails.
7. Type: Regular and Type X, in locations indicated.
8. Type X Thickness: 5/8 inch.
9. Manufacturers:
 - a. Cemco; Sure-Board: www.cemcosteel.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Ceilings, unless otherwise indicated.
 2. Thickness:
 - a. Non-rated: 1/2 inch.
 - b. Rated: 5/8 inch Type X.
 3. Edges: Tapered.
 4. Products:
 - a. American Gypsum; Interior Ceiling Board.
 - b. CertainTeed Corporation; ProRoc Interior Ceiling.
 - c. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board: www.gpgypsum.com/#sle.
 - d. National Gypsum Company; High Strength Brand Ceiling Board.
 - e. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
- F. Moisture Resistant Gypsum Sheathing: As specified in Section 06 16 53.
- G. Shaftwall and Coreboard: Type X.
 1. Panel 1: Facing shaft.
 - a. Basis of Design: Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant).
 - b. Thickness: 1 inch.
 - c. Panel: 24 inches wide, beveled long edges, ends square cut.
 - d. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
 - e. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 2. Panel 2: Facing Room.
 - a. Basis of Design: Georgia-Pacific Gypsum; ToughRock Fireguard X.
 - b. Thickness: 5/8 inch per panel. See Drawings for number of panels required to meet Fire Rating Requirements.
 - c. Panel: 48 inches wide, beveled long edges, ends square cut.
 - d. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 TILE BACKER BOARD

- A. Coated Glass Mat Gypsum Board:
 - 1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 2. Coated Glass Mat Backer Board: ASTM C1178/C1178M, with coated inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
 - a. Fire-Resistant Type: Type X core, thickness 5/8 inch.
 - 3. Products:
 - a. Georgia-Pacific Gypsum; DensGlass Tile Backer.
 - b. Temple-Inland Inc.; GreenGlass Tile Backer.
 - c. Substitutions: See Section 01 60 00 - Product requirements.
- B. Cementitious Backer Board (Cement Board): ANSI A118.9, aggregated portland cement panels with glass fiber mesh embedded in front and back surfaces, 1/2 inch thick.
 - 1. Product: Wonderboard manufactured by Custom Building Products.
 - 2. Product: DUROCK Cement Board manufactured by United States Gypsum Co.
 - 3. Product: Util-A-Crete manufactured by FinPan.

2.05 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustical Insulation: As specified in Section 07 21 00.
- B. Acoustic Sealant: As specified in Section 07 92 00.
- C. Water Resistant Sealant: Clear translucent silicone with mildew inhibitor.
 - 1. Manufacturer:
 - a. Dow Corning 786: www.dowcorning.com.
 - b. General Electric; www.geadvancedmaterials.com.
 - c. Tremco Proglaze: www.tremcosealants.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
 - 1. Form metal accessories from zinc-coated steel not lighter than: 0.012 inch.
 - 2. Types: As detailed or required for finished appearance.
 - 3. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
 - 4. Products:
 - a. Same manufacturer as framing materials.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 5. Casing beads: Provide channel shape with an exposed wing, and with a concealed wing not less than 7/8 inches wide, U-bead or LC-bead, to suit condition indicated.
 - 6. Corner beads: Provide angle shapes with wings not less than 7/8 inches wide and perforated for nailing and joint treatment, or with combination metal and paper wings bonded together, not less than 1-1/4 inches wide and suitable for joint treatment.
 - 7. Control Joints: One-piece control joint formed from rolled zinc with V-shaped slot and removable strip covering slot opening.

- E. Beads, Joint Accessories, and Other Trim for Rated Assemblies: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Corner Beads: 90 degree outside corners with 1-1/2 inch wings.
- F. Architectural Reveal Beads:
 - 1. Reveal Depth: 5/8 inch.
 - 2. Reveal Width: 1/4 inch.
 - 3. Shapes: As indicated on drawings.
 - 4. Products:
 - a. Trim-Tex, Inc: www.trim-tex.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- H. Screws: ASTM C1002; self-piercing tapping type, electroplated for exterior locations per ASTM B117 with a salt spray rating of 1000 hrs.
- I. Screws: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.
 - 1. Wood Studs: Not less than 1-1/4 inch long.
 - 2. Metal Studs: Not less than 1 inch long.
 - 3. Resilient Channel: Max 1 inch screws for first layer of gypsum board and max 1-1/2 inch screws for second layer
- J. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
 - 1. Fasteners: To meet Building Code requirements:
 - a. Expansion Bolts: ICC-ES AC193.
 - b. Screws: ICC-ES AC193.
 - c. Adhesive: ICC-ES AC308.
- K. Adhesive for Metal: Special adhesive recommended for fastening gypsum panels to steel framing.
- L. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field verify dimensions prior to installation; if dimensions vary significantly from Drawings, obtain Architect's approval before proceeding.
- B. Verify that project conditions are appropriate for work of this section to commence.
 - 1. Verify wood framing is dry with 19 percent maximum moisture content at time of covering.
 - 2. Correct conditions detrimental to timely and proper completion of Work.
 - 3. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Coordinate with other trades to assure proper and adequate provision in work of those trades for interface with Work of this Section.

3.03 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
 - 1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
 - 2. Install studs at spacing required to meet performance requirements.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
 - 1. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.04 FLAT DRYWALL SUSPENSION SYSTEM FRAMING

- A. Install suspended drywall framing system in accordance with manufacturer's instructions.
- B. Attach perimeter wall track or angle where grid suspension system meets vertical surfaces.
- C. Component and hanger wire installation:
 - 1. Flat Ceilings: Main tees shall be spaced a maximum of 48 inch on center and supported by hanger wires spaced a maximum 48 inch on center and as specified by UL Fire Resistance Directory attaching hanger wires directly to structure above.
 - 2. Cross tees shall be spaced per manufacturers' recommendations and as specified by UL Fire Resistance Directory.
 - 3. Transitions: Changes in Elevation in Soffit and Fascia Ceiling Applications.
 - a. When constructing stepped soffits, bracing of the drywall suspension system and/or additional hanger wires may be necessary to ensure stability and structural performance during and after drywall attachment.
 - b. Maximum vertical soffit height is 48 inch (Maximum unsupported drywall area shall not exceed 48" x 24"). Cross tee spacing in horizontal soffit plane is not to exceed 24". Intermediate cross tees are necessary to maintain visually acceptable drywall planes and drywall corners.
 - 4. General hanger wire notes: Hanger wires are required within 12 inch on both sides of a pivoted splice clip. At least 1 hanger wire is required within 12 inch of a transition clip.
 - 5. Limitations: Do not support wires from mechanical and/or electrical equipment occurring above ceiling.

3.05 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Acoustical Furring: Install resilient channels at maximum on center as indicated. Locate joints over framing members.
 - 1. Resilient channel shall be installed perpendicular to framing members.
 - a. Resilient channel (RC) used for walls: 24" o.c.
 - b. Resilient channel (RC) for ceilings: RC 24" o.c. if joists 16" o.c. and RC 16" o.c. if joists are 24" o.c.

2. Install the channel, orient resilient channel so that the open leg is facing up. Gypsum wallboard to be attached to top side, so the weight of gypsum board pulls channel away from studs.
 - a. Ensure that the correct brand and model of resilient channel is used.
 - 1) Orient resilient channel in the same direction, except for the end most channel, if needed.
 - b. Before installing the channel, shift the spacing horizontally to align the pre-drilled holes with the framing members
 - c. Where two adjacent pieces of RC must be spliced together, use one of the two following methods:
 - 1) Butt ends of RC together, leaving a 1/8" gap between pieces, and fasten each piece of RC to the framing member.
 - 2) Overlap the pieces of RC over the framing member and trim off any excess length so that the overlap does not extend beyond the edges of the framing member. Use a single screw to attach both sets of RC to the framing member.
 - d. Ensure that the RC is not short-circuited during construction by following these steps:
 - 1) Use the correct screw length - max. 1" for the first layer of 5/8" gypsum wall board and 1.5" for the second layer.
 - 2) Do not exert undue pressure on the gypsum board when mounting it to RC. This compresses the RC and can result in screws touching framing members.
 - 3) Avoid screwing the gypsum board to resilient channel near tapered edges of gypsum board.
 - 4) Do not overdrive screws. Screw heads should not sink in to the gypsum board more than 1/16" below the face of the board.
 - 5) Avoid screwing the gypsum board to resilient channel at locations that are in-line with the framing members. Mark the locations of the framing members before installation of gypsum board so that this can be avoided.
 3. Position channels 6 inch maximum distance from the wall-ceiling angle.
 4. Cantilever channel ends no more than 6 inch.
 5. Mount electrical boxes and other junction boxes to framing.
 6. Install gypsum board with 1/4 inch gap around perimeter of each room at all walls for acoustical sealant application. Seal gap using acoustical caulk.
 7. Use 1 inch screws on first layer of gypsum board and 1-5/8 inch screws on 2nd layer of gypsum board. Do not allow gypsum wallboard fasteners to touch the wall studs, or TJIs.
- B. RSIC-1 Clips:
1. Space resilient sound isolation clips at maximum of 24 x 48 inches on center
 2. Do not exceed design load of 36 pounds per isolation clip.
 3. Splicing drywall furring channels: Do not allow drywall furring channels or gypsum board to contact ceiling or wall framing members.
 4. Install gypsum board with 1/4 inch gap around perimeter of each room at all walls for acoustical sealant application. Seal gap using acoustical caulk.
 5. Install drywall furring channels perpendicular to framing members; spaced 24 inch on center.
 6. Locate resilient sound isolation clips maximum of 8 inch from ends of drywall furring channels.

7. Locate drywall furring channels maximum of 3 inch from parallel wall assemblies.
- C. Acoustical Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- D. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 1. Place continuous bead at perimeter of each layer of gypsum board.
 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.06 BOARD INSTALLATION

- A. General:
 1. Install gypsum board in accordance with ASTM C754 on non-loading bearing steel framing complying with ASTM C645.
 2. Install gypsum board in accordance with ASTM C955 on load bearing steel framing.
 3. Install gypsum board in light contact but not forced into place, with not more than 1/16 inch between panels.
 4. Support edges with framing members.
 5. Internal and external corners: Conceal cut edges of boards by overlapping covered edges of abutting boards.
 6. Maintain 3/8 inch minimum distance between fastener and board edge.
 - a. Drive specified screws with clutch-controlled power screwdrivers.
 - b. Dimple board surface 1/32 inch with fastener; do not fracture face paper.
 7. Isolate perimeter of non-load bearing partitions at structural abutments, except at floors.
 - a. Provide 1/4 to 2 inch wide joints at these locations.
 - b. Trim edges with U-bead edge trim where edges of gypsum board are exposed.
 - c. Seal joints with acoustical sealant.
 8. Isolate perimeter of partitions at ceilings.
 - a. Provide 1/2 inch wide uniform joint at these locations.
 - b. Trim edges with U-bead edge trim.
 - c. Seal joints with acoustical sealant or firestopping..
 9. Install with a minimum of 1/4 inch gap between gypsum board and floor.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Moisture-Resistant Gypsum Board:
 1. Install on walls in wet areas, such as toilet rooms, janitor's closets, and the like, except where glass-mat water-resistant gypsum tile backer board is installed for tile applications.
- D. Acoustical or Sound Partitions:
 1. Provide acoustical sealant to form an airtight seal at penetrations and perimeter of sound-rated partitions, floors and ceilings.
 2. Comply with ASTM C 919 for application of acoustical sealant at acoustical assemblies and sound rated partitions.
 - a. Install backer-rod at gaps to be sealed exceeding 3/8-inch.
 - b. Provide sheet caulking to seal back and sides of junction boxes, pipes, etc recessed in sound-rated partitions.

- c. Maintain a 1/4-inch air space around all junction boxes and seal airtight with acoustical sealant.
 - d. Partitions meet ceilings and floors: Apply continuous bead of sealant behind board edges and press back of board into sealant.
 3. Install resilient furring channels for partitions and ceilings, where shown or indicated.
- E. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- F. Glass Mat Faced Gypsum Board: Install in strict accordance with manufacturer's instructions.
- G. 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.
 1. Maintain 3/8 inch minimum distance between fastener and board edge.
 - a. Drive specified screws with clutch-controlled power screwdrivers.
 - b. Dimple board surface 1/32 inch with fastener; do not fracture face paper.
- H. Screw Fastener Schedule:
 1. Panel Perimeter Spacing: 8 inches o.c., unless otherwise noted.
 2. Panel Intermediate Support Spacing:
 - a. Walls: 12 inches o.c., typical.
 - b. Walls with Panels as Tile Substrate: 8 inches o.c.
 - c. Ceilings: 8 inches o.c.
- I. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.07 CEILING INSTALLATION

- A. Install gypsum board to ceilings with long dimension of board at right angles to supporting members.
- B. Board may be installed with long dimension parallel to supporting members that are spaced 16 inches o.c. when attachment members are provided at end joints.
- C. Where water-resistant board is used at ceilings, provide supports at 12 inches o.c.
- D. Multilayer Applications:
 1. Offset face layer joints at least one stud or furring member from base layer joints.
 2. Fasten both base layer and face layer with screws, and with adhesive between layers.

3.08 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces, GA-216 and as indicated.
 1. Not more than 30 feet apart on walls and ceilings over 30 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
 1. Install specified corner bead, fitting neatly over corner and securing with same type fasteners used for installing wallboard.
 2. Space fasteners approximately 6 inches o.c. and drive through wallboard into framing or furring member.
 3. After corner bead has been secured into position, treat corner with joint compound and reinforcing tape as specified for joints, feathering joint compound out from 8 to 10 inches

on each side of corner.

- C. Internal corners: Treat as specified for joints, but fold reinforcing tape lengthwise through middle and fit neatly into corner.
- D. Trim Locations:
 - 1. Drawings do not show locations and requirements for trim.
 - 2. Carefully study Drawings and installation, and provide trim normally recommended by manufacturer of gypsum board.
 - 3. Install rolled formed profiles where indicated.
- E. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.09 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Verify that gypsum board is fastened as specified to supporting framework.
- C. Finish gypsum board in scheduled areas in accordance with levels defined in NWCB GWB 2 & 3, ASTM C 840 and as scheduled below.
 - 1. Above Finished Ceilings Concealed From View: Level 1.
 - 2. Utility Areas and Areas Behind Cabinetry: Level 2.
 - 3. Walls and Ceilings to Receive Flat or Eggshell Paint Finish: Level 4.
 - 4. Level 1 Finish: One coat application.
 - a. Embed tape in joint compound with surfaces free of excess joint compound.
 - b. Tool marks and ridges are acceptable.
 - c. Cover fastener heads with one coat of joint compound in fire resistive assemblies.
 - 5. Level 2 Finish: One coat application.
 - a. Embed tape in joint compound, wipe off excess and leave a thin coat of joint compound over tape.
 - b. Tool marks and ridges are acceptable.
 - c. Cover fastener heads with one coat of joint compound.
 - 6. Level 3 Finish: Two coat application for texture finish.
 - a. Embed tape in joint compound, wipe off excess and leave a thin coat of joint compound over tape.
 - b. Cover fastener heads with one coat of joint compound.
 - c. Apply separate coat of joint compound over dry first coat, leaving smooth surface free of ridges, tool marks, sanding grooves and other imperfections.
 - d. Apply specified texture finish.
 - 7. Level 4 Finish: Three coat application.
 - a. Embed tape in joint compound leaving a smooth thin coat of joint compound over tape.
 - b. Apply separate coat of joint compound over dry first coat, leaving smooth surface free of ridges, tool marks and sanding grooves.
 - c. Apply final coat of joint compound feathered out over dry second coat, leaving smooth surface flush with gypsum board and free of marks.
 - 1) Feather finishing compound to not less than 12 inches wide.

- d. Cover fastener heads with coat of joint compound followed with separate second and final coats as described above for taped joints.
 - e. When finishing compounds are dry, sandpaper to obtain uniformly smooth surface, taking care to not scuff paper surface of wallboard.
 - f. Wipe gypsum board surfaces with damp cloth.
8. Level 5 Finish:
- a. Same as Level 4 Finish plus the following:
 - b. Spray apply high build drywall surfacer or joint compound over entire gypsum board surface after joints have been properly treated.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Apply joint treatment and finishing compound by machine or hand tool.
 2. Apply joint tape over joints and to flanges of trim accessories except those with trim accessories not requiring tape.
 3. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.10 WATER RESISTANT SEALANT

- A. Apply a continuous bead of water resistant sealant around cutouts at raw edges and at penetrations of water-resistant gypsum board and glass-mat water resistant tile backer board.

3.11 FINISH

- A. Wall: Smooth.
- B. Ceilings: Smooth.

3.12 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet and 1/16 inch in any running foot.
 1. Check trim for conformance to tolerances.

3.13 REPAIRS

- A. Repair screw pops by installing new screw approximately 1-1/2 inches away from projecting screw and reset projecting screw if face paper is fractured, remove projecting screw, fill damaged surface and finish flush and smooth.
- B. Fill cracks; finish flush and smooth.

3.14 CLEANING UP

- A. Clean, without damaging, exposed surfaces affected by Work of this Section, and repair as necessary.
- B. In addition to other requirements for cleaning, use necessary care to prevent scattering gypsum board scraps and dust, and to prevent tracking gypsum and joint finishing compound onto floor surfaces.
- C. Remove scrap, debris, and surplus material of this Section at completion of each segment of installation and dispose per Section 01 74 19.

3.15 FINISH LEVEL SCHEDULE

- A. Level 1:
 - 1. Above ceiling and concealed areas, unless higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
- B. Level 2:
 - 1. Areas behind cabinetry.
 - 2. Utility Areas.
 - 3. Substrate for tile.
- C. Level 4: Walls and ceilings scheduled.
 - 1. Standard units and corridors.
- D. Level 5: Walls and ceilings scheduled.
 - 1. Lobby walls and ceilings.

END OF SECTION

**SECTION 09 30 00
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Tile for shower receptors.
- D. Coated glass mat backer board as tile substrate.
- E. Tile accessories.
- F. Tile trim.
- G. Non-tile trim.
- H. Acoustical Isolation Pad

1.02 REFERENCE STANDARDS

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).
- E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.
- F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
- G. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.
- H. 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).
- I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).
- J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
- K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.

- L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).
- M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).
- N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2020.
- O. 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.
- P. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2019.
- Q. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2019.
- R. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2014 (Reaffirmed 2019).
- S. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).
- T. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2019.
- U. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- V. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers 2020.
- W. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- X. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
- Y. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- Z. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- AA. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2022.
- BB. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2022.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.05 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. See Section 09 06 02 - Materials and Finishes Schedule.

2.02 TRIM AND ACCESSORIES

- A. Tile Transition Strip: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
 - 1. Manufacturers: Same as for tile.
- B. Non-Tile Transition Strip: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. See 09 06 02 Materials and Finishes Schedule for finish.
 - 2. Applications:
 - a. Open edges of wall tile.
 - b. Open edges of floor tile.
 - c. Wall corners, outside and inside.
 - d. Transition between floor finishes of different heights.
 - e. Expansion and control joints, floor and wall.
 - f. Floor to wall joints.
 - g. Borders and other trim as indicated on drawings.

2.03 SETTING MATERIALS

- A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
 - 1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
 - 2. Products:
 - a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; MULTIMAX LITE: www.laticrete.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GROUTS

- A. See, Section 09 06 02 Materials and Finishes Schedule for Grout Type and width.

- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. ARDEX Engineered Cements; ARDEX FL: www.ardexamericas.com.
 - b. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com.
 - c. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com.
 - d. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 - e. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Sanded - Standard Grout: ANSI A118.6 standard cement grout.
 - 1. Applications: Use this type of grout where indicated .
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. Custom Building Products; Polyblend Sanded Grout: www.custombuildingproducts.com.
 - b. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: www.laticrete.com.
 - c. Merkrete, by Parex USA, Inc; Versatile DuraColor Sanded: www.merkrete.com/sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Non Sanded - Standard Grout: ANSI A118.6 standard cement grout.
 - 1. Applications: Use this type of grout where indicated and for glass tile or polished surfaces to avoid scratching.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. Custom Building Products; Polyblend Non-Sanded Grout: www.custombuildingproducts.com.
 - b. LATICRETE International, Inc; LATICRETE 1600 Unsanded Grout: www.laticrete.com.
 - c. Merkrete, by Parex USA, Inc; Versatile DuraColor Non-Sanded: www.merkrete.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 - 1. Applications: Where indicated.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com.
 - b. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com.
 - c. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 MAINTENANCE MATERIALS

- A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
 - 1. Composition: Water-based colorless silicone.
 - 2. Application: Protect tile and install grout sealer to grout only unless noted otherwise.
 - 3. Products:
 - a. Merkrete, by Parex USA, Inc; Merkrete Revive: www.merkrete.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORY MATERIALS

- A. Gypsum Board Primer: As recommended by Tile Manufacturer.
- B. Leveling and Patching Compound: Trowelable, nonflammable, as recommended by tile manufacturer.
- C. Self-Leveling and Patching Compound: Pre-blended cementitious, for thicknesses from feather edge to 1/2 inch.
 - 1. Products:
 - a. Compatible compound with thin-set materials, adhesives and grouts.
 - 2. Primer: As recommended by topping manufacturer.
- D. Tile Expansion Joint: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type per ASTM C920.
 - 1. Applications: Allowing for movement between tiles.
 - 2. Color(s): As indicated on drawings.
 - 3. Products:
 - a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
 - d. Merkrete, by Parex USA, Inc; MK 100% Silicone Caulk: www.merkrete.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Crack Resistance: No failure at 1/8 inch gap, minimum.
 - 2. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 20 mils, maximum.
 - c. Products:
 - 1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
 - 2) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
 - 3) Sika Corp; SikaTile 200 Fracture Guard Rapid: www.sika.com/#sle.

- F. Interior Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber.
 - b. Thickness: 25 mils, minimum, dry film thickness.
 - c. Products:
 - 1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
 - 2) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000: www.merkrete.com/#sle.
 - 3) Sika Corp; SikaTile 100 Moisture Guard: www.sika.com/#sle.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- G. Cleaning Materials:
1. American Olean Tile Co. Division
 2. National Gypsum Co.
 3. Hillyard Chemical Co.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Color Enhancer:
1. Manufacturer: Miracle Sealants Co.
 - a. Mira Matte.
 2. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
1. Floor surface to be within 1/8 inch in 10'-0" for thin set tile (Minimum Localized Value (MLV) of 50.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710. Verify pH range of 5 to 9.
 - b. Internal Relative Humidity: ASTM F2170, 75%.
 - c. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869 and ASTM F2170.
 2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
- C. Correct conditions detrimental to proper and timely completion of Work.

3.02 PREPARATION

- A. Clean existing concrete floor surface as recommended in forward to ANSI A 108.5 and ANSI A 108.6.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with leveling and patching compound to achieve smooth, flat, hard surface.

1. Irregularities not to exceed F(F): Specified Overall Value (SOV) of 50; Minimum Localized Value (MLV) of 50, not to exceed 1/8 inch in 10 feet.
- C. Protect surrounding work from damage.
- D. Vacuum clean surfaces and damp clean.
- E. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL

- A. Acoustical Isolation Pad: Install as indicated on drawings and/or called for in TCNA assembly.
- B. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19, manufacturer's instructions, and TCNA (HB) recommendations.
- C. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
 1. Joints:
 - a. Lay tile in pattern indicated on Drawings with aligned joints.
 - b. Adjust joints to minimize tile cutting.
 - c. Provide uniform joints.
 - d. Install sealant at joints between tile and plumbing fixtures
- D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- F. Form internal angles square and external angles bullnosed.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- N. Metal Edge Strips: Install at locations indicated, or where exposed edge of tile meets carpet, wood, or other flooring that finishes flush with top of tile.
- O. Subdrainage System: Install where shown on drawings and/or called for in TCNA Assembly.
- P. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Acoustical Isolation Pad: Install where shown on drawings and per manufacturers recommendation.

- B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
 - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
- C. Over wood substrates and cast underlayment, install in accordance with TCNA Handbook Method F180 with waterproof membrane, with standard grout and bonded crack isolation, unless otherwise indicated.

3.05 INSTALLATION - FLOORS - MEDIUM BED (LARGE FORMAT TILE)

- A. Acoustical Isolation Pad: Install where shown on drawings and per manufacturers recommendation.
- B. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
- C. Waterproofing Membrane: Install as recommended by manufacturer and as specified in the section in which the product is specified.
- D. Mortar Bed Thickness: 5/8 inch, unless otherwise indicated.

3.06 INSTALLATION - FLOORS - MORTAR BED METHODS

- A. Acoustical Isolation Pad: Install where shown on drawings and per manufacturers recommendation.
- B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
- C. Over wood substrates, install in accordance with TCNA (HB) Method F141, with standard grout, unless otherwise indicated.
- D. Mortar Bed Thickness: 5/8 inch, unless otherwise indicated.

3.07 INSTALLATION - WALL TILE

- A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCNA (HB) Method W222, one coat method.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. Independent testing agency will inspect concrete surface for conformance to contract documents.
- C. Provide free access to concrete inspection and testing at project site and cooperate with appointed firm.

D. Flatness and Levelness Tolerances:

1. Measure floor slabs for suspended floors and slabs-on-grade to verify compliance with tolerance requirements of ASTM E1155 and ACI 117.
2. Floor Profiler:
 - a. Dipstick by Face Construction Technologies.
3. Measure floor finish tolerances 2 week prior to start of Work.
4. Make repairs to obtain specified Flatness.

END OF SECTION

SECTION 09 51 00
SUSPENDED ACOUSTICAL CEILINGS (ACT)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Lateral support
- C. 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. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- D. 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.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.
- F. CISCA (AC) - Acoustical Ceilings: Use and Practice 1999.
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.

1.03 PERFORMANCE REQUIREMENTS

- A. Suspension System: Designed for appropriate forces per Building Code and conform to the following:
 - 1. Perform design under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State in which the Project is located.
 - 2. Provide for Occupancy category III and IV.
 - 3. Seismic Design Category D, E, & F, construction in accordance with CISCA (AC) standard for seismic zones 3 and 4 with modifications as noted ASCE 7 standard.
 - 4. Special inspection structure anchorage as required by the authority having jurisdiction.
- B. Prescriptive Design Suspension System: Conform with the following:
 - 1. Provide for Occupancy category I and II only.
 - 2. Ceilings with interstitial spaces less than 12 inches to framing are not required to have lateral force bracing.
 - 3. Shot-in Anchors in seismic design categories D, E, and F to have ICC-ES approval for seismic applications and overhead installations.
 - a. Special inspection as required by the authority having jurisdiction.
 - 4. Northwest Wall & Ceiling Bureau - Technical Bulletin 401.

5. Lateral force bracing required for ceilings over 144 sq. ft.

1.04 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate lateral restraint, anchorage, grid layout and related dimensioning, compression post installation, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on suspension system components and acoustical units.

1.05 DOCUMENTATION FOR SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for site information:
 1. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
 2. Coordination Drawings.
 3. Other types indicated.
- D. Documentation for Site Information maybe reviewed by Architect for reference.

1.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Submittals for Site information.
 4. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

- A. Manufacturers:
 1. See Section 09 06 02 - Materials and Finishes Schedule for acoustical panel designations.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Acoustical Units - General: ASTM E1264, Class A.

2.02 SUSPENSION SYSTEM(S)

- A. Manufacturers:
 1. Basis of Design: Armstrong World Industries, Inc: www.armstrong.com.
 2. USG; Product Donn: www.usg.com.
 3. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required to meet seismic requirements indicated on drawings and specified herein.
 - 1. Design per Building Code for seismic categories D, E, & F, ASCE 7-02 or 05, CISA recommendation for seismic zones 3 & 4.
- C. Exposed Steel Suspension System Type ACP-3: Formed steel, commercial quality cold rolled; heavy-duty.
 - 1. Profile: Tee; 1-1/2 inch wide face.
 - 2. Construction: Double web.
 - 3. Finish: White painted.
 - 4. Adjustable seismic compression posts by USG Interiors.
 - 5. Gasketing: Type V764, Norton Closed Cell Foam Gasketing, Field applied.
 - 6. Retention Clips: #414.
 - 7. Product: Clean Room Grid System by Armstrong World Industries, Inc.
- D. Exposed Steel Suspension System Type ACP-4: Formed steel, commercial quality cold rolled; heavy-duty.
 - 1. Profile: Tee; 15/16 inch wide face.
 - 2. Construction: Double web.
 - 3. Finish: White painted.
 - 4. Product: Prelude by Armstrong World Industries, Inc.

2.03 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
 - 1. Hanger Wire: Galvanized carbon steel, soft temper, prestretched, yield stress load at least three times design load, but not less than 12 gauge.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- E. Perimeter Moldings: Same metal and finish as grid.
 - 1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
- F. Fasteners: To meet Building Code requirements.
 - 1. Expansion Bolts: ICC Evaluation Report ICC-ES AC193.
 - 2. Screws: ICC Evaluation Report ICC-ES AC193.
 - 3. Adhesive: ICC Evaluation Report ICC-ES AC308.
 - 4. Power Activated Fasteners: As permitted by Building Code.
- G. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 92 00.

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.
 - 1. Correct conditions detrimental to timely and proper completion of Work.
- C. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, ASTM C 636/C 636M, ASTM E 580/E 580M, ASTM C 636/C 636M, and ASTM E 580/E 580M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lateral bracing:
 - 1. Provide lateral bracing as required by Building Code.
 - 2. Secure lateral bracing to structural members.
 - 3. Secure lateral bracing at right angles to direction of partition and four ways in large ceiling areas.
- D. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- E. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- F. 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.
- G. 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.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.
- K. 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.
- L. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.

- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units with pattern parallel to longest room axis.
 - 1. Edge panels to be equal and 4 inches, minimum wide.
- D. Fit border trim neatly against abutting surfaces.
- E. Install units after above-ceiling work is complete.
- F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- G. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements or governmental agencies having jurisdiction.

3.04 CLEANING

- A. Clean surfaces of grid and acoustical materials.
- B. Use cleaning materials recommended for purpose by manufacturer of material being cleaned.
- C. Remove and replace panels and tiles that cannot be successfully cleaned and repaired to eliminate evidence of damage.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

**SECTION 09 54 23
LINEAR METAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Linear metal ceilings.
- B. Suspended metal support system and perimeter trim.

1.02 REFERENCE STANDARDS

- A. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. 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.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.
- B. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Furnish for component profiles.
- C. Shop Drawings: Indicate reflected ceiling plan.

1.05 DOCUMENTATION FOR SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for site information:
 - 1. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
 - 2. Coordination Drawings.
 - 3. Other types indicated.
- D. Documentation for Site Information maybe reviewed by Architect for reference.

1.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:

1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Submittals for Site information.
 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.
- C. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Linear Metal Ceilings:
1. Armstrong World Industries, Inc; Metal Works Mesh: www.armstrongceilings.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LINEAR METAL CEILINGS

- A. Linear Metal Ceiling System: Panels, suspension members, trim, and accessories as required to provide a complete system.
- B. See Section 09 06 02 Materials and Finishes Schedule.
- C. Performance Requirements:
1. Design to support imposed loads of indicated items without eccentric loading of supports.
 2. Design for maximum deflection of 1/360 of span.
 3. Surface Burning Characteristics: Flame spread index of 25, smoke developed index of 50, when tested in accordance with ASTM E84.

2.03 COMPONENTS

- A. Type: ACT-2: Linear Metal Panels:
1. Type: Linear panel with reveals; square lay-in installation.
 - a. Size and Configuration: As indicated on drawings.
 - b. Panel Profile: Channel shaped with square edges.
 - c. Spacing: ____ inch reveal between panels.

- B. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.
- C. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.
- D. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.
- E. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
 - 1. See Section 09 51 00.
- F. Suspension Wire: Size and type as required for application, seismic requirements, and ceiling system flatness requirement specified.
- G. Subgirt Members: Prime painted steel sheet, formed to resist imposed loads and to provide attachment for linear ceiling and accessories.

2.04 FABRICATION

- A. Shop cut linear panels to accommodate mechanical and electrical items.
- B. Factory-form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels ; back brace internal corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that required utilities are available, in proper location, and ready for use.

3.02 INSTALLATION

- A. Suspension Components:
 - 1. Install after above-ceiling work is complete in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, ASTM C 636/C 636M, ASTM E 580/E 580M, ASTM C 636/C 636M, and ASTM E 580/E 580M.
 - 2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
 - 3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
- B. Linear Metal Ceiling:
 - 1. Install linear panels and other system components in accordance with manufacturer's instructions.

3.03 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.

- C. Maximum Variation From Dimensioned Position: 1/4 inch.

3.04 CLEANING

- A. Clean surfaces.
- B. Replace damaged or abraded components.

END OF SECTION

**SECTION 09 65 00
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient sheet flooring.
- B. Resilient tile flooring.
- C. Resilient base.
- D. Installation accessories.

1.02 REFERENCE STANDARDS

- A. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2014 (Reaffirmed 2019).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- D. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing 2004 (Reapproved 2021).
- E. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.
- F. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- G. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering 2018.
- H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plan and tile layout.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Verification Samples: Submit two samples, ___ by ___ inch in size illustrating color and pattern for each resilient flooring product specified.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
 - 1. For linoleum flooring, report rapidly-renewable content and urea-formaldehyde content.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect roll materials from damage by storing on end.

1.05 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.

PART 2 PRODUCTS

- A. See Section 09 06 02 for Flooring Types.
- B. Vinyl Sheet Flooring : Heterogeneous with color and pattern throughout wear layer thickness, with backing, and:
 - 1. Manufacturers and Types: See Section 09 06 02.
 - a. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Minimum Requirements: Comply with ASTM F1303.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
 - 4. Total Thickness: 0.10 inch minimum.
 - 5. Pattern: Marbleized.
- C. Linoleum Sheet Flooring: Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
 - 1. Manufacturers and Types: See Section 09 06 02.
 - a. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Minimum Requirements: Comply with ASTM F2034, Type corresponding to type specified.
 - 3. Backing: Jute fabric.
 - 4. Backing: Organic.
 - 5. Thickness: 0.100 inch, minimum, excluding backing.
 - 6. Sheet Width: 79 inch, minimum.

2.02 TILE FLOORING

- A. Vinyl Plank: Solid vinyl with color and pattern throughout thickness, and:
 - 1. Manufacturers and Types: See Section 09 06 02.
 - a. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Minimum Requirements: Comply with ASTM F 1700, of Class corresponding to type specified.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
 - 4. Size: 6 x 48 inch.
 - 5. Wear Layer Thickness: 0.020 inch.
 - 6. Pattern: As scheduled.

2.03 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set, Style A, Straight and Style B, Cove, and as follows:
 - 1. Manufacturers:
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
 - 3. Height: 4 inch.
 - 4. Thickness: 0.125 inch.
 - 5. Finish: Satin.
 - 6. Length: 4 foot sections.
- B. Tub Molding: ASTM F1861, Type TV, vinyl, thermoplastic; Style B, Cove.
 - 1. Manufacturers:
 - a. Flexco, Inc: www.flexcofloors.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Height: 1 inch.
 - 3. Thickness: 0.125 inch thick.
 - 4. Finish: Satin.
 - 5. Color: Color as selected from manufacturer's standards.

2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Acoustical Isolation Pad:
 - 1. Quiet Qurl 55/025 MC by Keene Building Products: www.keenebuilding.com.
 - a. Description: Monofilament core with reinforced scrim.
 - b. Thickness: 1/4 inch.
 - 2. Impacta VC 300 by Sound Seal; www.soundseal.com.
 - a. Description: Foam and cork granules.
 - b. Thickness: 1/8 inch.
 - 3. Impacta Jumpax by Sound Seal; www.soundseal.com.
 - a. Description: MDF, polystyrene foam with aluminum film.
 - b. Thickness: 3/8 inch.
 - 4. Seam Tape: Provide seam tape as recommended by manufacturer.
- D. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under resilient flooring; complying with ANSI A118.10.
 - 1. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 25 mils, minimum, dry film thickness.

- c. Products:
 - 1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
 - 2) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com/#sle.
 - 3) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
 - 4) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
 - 5) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000: www.merkrete.com/#sle.
 - 6) Substitutions: See Section 01 60 00 - Product Requirements.
- E. Filler for Coved Base: Plastic.
- F. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Verify that concrete sub-floor and self leveling underlayment surfaces are dry enough and ready for wood flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710 and ASTM F2170; obtain instructions if test results are not within limits recommended by wood flooring manufacturer and adhesive materials manufacturer.
 - 1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft per 24 hours when tested.
 - 2. Alkalinity: pH range of 5-9.
 - 3. In-Situ Relative Humidity: 75%.
- D. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.

2. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.
 3. Fit joints and butt seams tightly.
 4. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- G. Install in accordance with manufacturer's instructions.
- H. Seams are prohibited in bathrooms, kitchens, toilet rooms, and custodial closets.
- I. Cut sheet at seams in accordance with manufacturer's instructions.
- J. Seal seams by heat welding where indicated.
- K. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.
- L. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Scribe and fit to door frames and other interruptions.
- D. Types: Unless noted otherwise.
 1. Style A: Straight Base - Carpeting.
 2. Style B: Cove Base - Resilient Flooring.

END OF SECTION

**SECTION 09 65 66
RESILIENT ATHLETIC FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rubber sheet flooring, adhesively installed.
- B. Rubber tile, adhesively installed.
- C. Interlocking, loose-laid rubber tile.

1.02 REFERENCE STANDARDS

- A. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine 2017.
- B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).
- C. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading 2022.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication, flooring layout, installation details, and colors. Widths of game lines and equipment locations.
- D. Selection Samples: Manufacturer's color charts for flooring materials specified, indicating full range of colors and textures available.
- E. Verification Samples: Actual flooring material specified, not less than 12 inch square, mounted on solid backing.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
- B. 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.

1.06 FIELD CONDITIONS

- A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F or to go above 100 degrees F.

1.07 WARRANTY

- A. Provide manufacturer's standard 10 year wall to wall limited commercial warranty to cover manufacturing defects.

PART 2 PRODUCTS

2.01 PREFORMED ATHLETIC FLOORING

- A. Manufacturers:
 - 1. See Section 09 06 02 Materials and Finishes Schedule.
- B. Rubber Sheet Flooring: Two-layer vulcanized rubber.
 - 1. Thickness: Minimum 7 mm .28 inch.
 - 2. Sheet Width: Minimum 72 inches.
 - 3. Durometer Hardness, Type A: Minimum of 75, when tested in accordance with ASTM D2240.
 - 4. Surface Texture: Smooth.
 - 5. Surface Pattern: See Section 09 06 02 Materials and Finishes Schedule..
 - 6. Color: As selected from manufacturer's standard range.
 - 7. Seams: Heat welded.
 - 8. Base: 4" Sanitary.
 - 9. Coefficient of Friction: >0.6.
- C. Rubber Tile Flooring: Recycled vulcanized rubber and colored granules.
 - 1. Thickness: Minimum 3/8 inch.
 - 2. Tile Edge/Installation: Straight, adhesive installation.
 - 3. Size, Straight Edge Tile: Nominal As indicated on drawings.
 - 4. Durometer Hardness, Type A: Minimum of 70, when tested in accordance with ASTM D2240.
 - 5. Surface Texture: Smooth.
 - 6. Static Coefficient of Friction; > 0.8 per ASTM D2047.
 - 7. Modified Static Load Limit; Passes 1,000 PSI per ASTM F970.
 - 8. Critical Radiant Flux; Class 1, > 0.45 W/cm² per ASTM F648/ NFPA 253.
 - 9. Color: See Section 09 06 02 Materials and Finishes Schedule..

2.02 ACCESSORIES

- A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.
- B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius.
- C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.
- D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Resilient Sheet Flooring:
 - 1. Unroll flooring and allow to relax before beginning installation.
 - 2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
 - 3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
 - 4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.
 - 5. Weld seams using techniques and equipment recommended by manufacturer.
 - 6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
 - 7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform finished appearance.
- D. Rubber Tile Flooring:
 - 1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.

2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.
3. Spread only enough adhesive to permit installation of materials before initial set.
4. Fit joints and butt seams tightly; press with heavy roller to attain full adhesion.

3.04 CLEANING

- A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

- A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

**SECTION 09 68 13
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- F. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.
- G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate layout of joints and direction of carpet pile.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Submit two, 6 inch long samples of edge strip, base cap, and stair nosing.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.04 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Tile Carpeting: See Section 09 06 02 Materials and Finishes Schedule.
 - 1. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.

2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
3. VOC Content: Provide CRI (GLP) certified product; in lieu of labeling, independent test report showing compliance is acceptable.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Transition Strips: Embossed aluminum, color as selected by Architect.
- C. Adhesives:
 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
 3. Moisture emission rate: Not greater than 3 lb per 1000 sq ft per 24 hours when tested using calcium chloride moisture test kit for 72 hours.
 4. Alkalinity: pH range of 5-9.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Apply floor filler between different carpets thickness to achieve flush surface between different pile heights. Transitional slope to be 1/8 inch per foot.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.
- C. Remove and recycle debris from project site per Section 01 74 19.

END OF SECTION

**SECTION 09 68 16
SHEET CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet, stretched-in with cushion underlay and direct-glued.
- B. Accessories.

1.02 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- C. CRI 104 - Standard for Installation of Commercial Carpet 2015.
- D. CRI (GL) - Green Label Testing Program - Certified Products Current Edition.
- E. CRI 104 - Standard for Installation of Commercial Textile Floorcovering Materials; Carpet and Rug Institute; 2002.
- F. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.
- G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.05 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

- B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
- C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 CARPET

- A. Carpet, Type See Section 09 06 02 Materials and Finishes Schedule:
 - 1. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
 - 2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
 - 3. VOC Content: Provide CRI (GLP) certified product; in lieu of labeling, independent test report showing compliance is acceptable.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CUSHION

- A. Cushion: Cellular rubber.

2.03 ACCESSORIES

- A. Subfloor Filler: Type recommended by carpet manufacturer.
- B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.
- C. Transition Strips: Rubber, color as selected.
- D. Adhesives:
 - 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GL) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft per 24 hours when tested using calcium chloride moisture test kit for 72 hours.
 - 2. Alkalinity: pH range of 5-9.
 - 3. In-Situ Relative Humidity: 75%

4. 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.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Apply floor filler between different carpets thickness to achieve flush surface between different pile heights. Transitional slope to be 1/8 inch per foot.
- D. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104.
- D. Verify carpet match before cutting to ensure minimal variation between dye lots.
- E. Lay out carpet and locate seams in accordance with shop drawings.
 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 2. Do not locate seams perpendicular through door openings.
 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 4. Locate seams the length of the area. Laddering or staggered seams not permitted.
 5. Locate change of color or pattern between rooms under door centerline.
 6. Provide monolithic color, pattern, and texture match within any one area.
- F. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 INSTALLATION ON STAIRS

- A. Install tackless strips at back of treads, with pins facing riser, and at bottom of riser, with pins facing tread.
- B. Install cushion on stair treads butt tight to applied nosing.
- C. Install carpet on stairs with the run of the pile in opposite direction of anticipated traffic to avoid peaking of backing at nosings.
- D. Stretch carpet over stair treads, full width in one piece. Fold carpet under 1-1/2 inches on each side.

3.05 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.

- B. Clean and vacuum carpet surfaces.
- C. Remove and recycle debris from project site per Section 01 74 19.

END OF SECTION

**SECTION 09 72 00
WALL COVERINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation and prime painting.
- B. Wall covering.

1.02 REFERENCE STANDARDS

- A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems 2020.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2020.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit two samples of wall covering, 6 by 6 inch in size illustrating color, finish, and texture.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.05 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. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.
- B. Wall Covering - Type See Section 09 06 02 Materials and Finishes Schedule: Fabric-backed vinyl roll stock.
 1. Comply with ASTM F793/F793M, Category V, Type II.
- C. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.
- D. Termination Trim:
 1. Application: Outside Corner Guard.
 2. Product: Arte International; Profolio Corner Guard; www.arte-international.com/en/gusset.
- E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- F. 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.

3.02 PREPARATION

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- E. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering.
- C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- D. Butt edges tightly.
- E. Horizontal seams are not acceptable.
- F. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
- G. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- H. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 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.

3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

**SECTION 09 78 00
INTERIOR WALL PANELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 REFERENCE STANDARDS

- A. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials 2012 (Reapproved 2020).
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's descriptive literature for each specified product. Include anchorage devices specific to project substrate types.
- C. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.
- D. Samples: Submit two samples 12 by 12 inches in size, indicating finish, surface design, and color for each type of panels.
- E. Manufacturer's Instructions: Provide manufacturer's installation instructions.
- F. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.
- G. Specimen Warranty: Manufacturer warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.
- B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a 10-year period for failure of materials or workmanship commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Resin Composite Panels:

1. TorZo Surfaces.; www.torzosurfaces.com.

2.02 REGULATORY REQUIREMENTS

- A. Surface Burning Classification: Provide wall paneling assemblies meeting Class B when tested in accordance with ASTM E84.

2.03 COMPOSITE WALL PANELS

- A. Resin Infused Composite Panels:
 1. Product: Durum.
 2. Sustainable content: 70 percent pre-consumer recycled and rapidly renewable wheat straw.
 3. Free from added urea formaldehyde.
 4. Color: See Section 09 06 02 Materials and Finishes Schedule.
 5. Thickness: As indicated on drawings, tested to ASTM D1037.
 6. Physical characteristics:
 - a. Density: 72, tested to ASTM D2395.
 - b. Internal bond: 325, tested to ASTM D1037.
 - c. Modulus of rupture: 7432, tested to ASTM D1037.
 - d. Modulus of elasticity: 897,792, tested to ASTM D1037.
 - e. Hardness, Janka ball: 4225, tested to ASTM D1037.
 - f. Screw holding; tested to ASTM D1037:
 - 1) Face: 672.
 - 2) Edge: 681.
 - g. Linear expansion: 0.13, tested to ASTM D1037.
 - h. Moisture content: 2.5, tested to ASTM D4442.
 - i. Fire rating: Class B, tested to ASTM E84.

2.04 ACCESSORIES

- A. Adhesives:
 1. Type recommended by resin infused composite panel manufacturer.
- B. Filler: Color-matched wood filler or solid surface epoxy.
- C. Finish: Factory finish, Clear.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions.
- B. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.
- C. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.
- D. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.
- E. Install panels with manufacturer's recommended gaps for panel field and corner joints.
- F. Install trim with adhesive.

- G. Seal joints at wall base and between panels with approved sealant to prevent moisture intrusion.
- H. Remove excess sealant after paneling is installed and prior to curing.

3.02 CLEANING

- A. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

3.03 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals for closeout submittals.

3.04 PROTECTION

- A. Protect installed interior wall paneling from subsequent construction operations.

END OF SECTION

SECTION 09 83 13
ACOUSTICAL WOOD FIBER CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical units.

1.02 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 2023.
- C. CISCA (AC) - Acoustical Ceilings: Use and Practice 1999.

1.03 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread less than 0, smoke developed less than 0; Class A, per ASTM E84.
- B. Noise Reduction Coefficient (NRC): Minimum 1.0, measured in accordance with ASTM C423.

1.04 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's product data and installation instructions.
- C. Samples: Submit selection and verification samples: 6 inch × 6 inch sample for each wood fiber ceiling unit required, showing full range of exposed texture to be expected in completed work.

1.05 DOCUMENTATION FOR SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for site information:
 - 1. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.
 - 2. Installer's qualification statement:
 - 3. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
 - 4. Other types indicated.
- D. Documentation for Site Information maybe reviewed by Architect for reference.

1.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Submittals for Site information.
 - 4. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. Provide new unopened carton of extra materials, packaged with protective covering for storage and identified with appropriate labels.
 - 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.08 DELIVERY, STORAGE & HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 1. Provide labels indicating brand name, style, size and thickness.
- B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
 - 1. Prevent soiling, physical damage or wetting.
 - 2. Store cartons open at each end to stabilize moisture content and temperature.

1.09 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install ceiling panels until building is closed in and HVAC system is operational.
 - 2. Locate materials on-site at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
 - 3. Maintain following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
 - a. Relative Humidity: 65 - 75%.
 - b. Uniform Temperature: 55 - 70 degrees F.

PART 2 PRODUCTS

2.01 ACOUSTICAL CEILING SYSTEM

- A. Type: ACT-1:
 - 1. Manufacturer: Tectum by Armstrong World Industries; www.armstrongceilings.com.
 - 2. Product: See Section 09 06 02 Materials and Finishes Schedule.
- B. Acoustical ceiling systems, including following:
 - 1. Surface Texture: Coarse

2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement.
 3. Finish: Surface appearance shall be consistent from panel to panel
 4. Color: Natural.
 5. Size: See Section 09 06 02 Materials and Finishes Schedule
 6. UL Classified Noise Reduction Coefficient (NRC): ASTM C 423 ; Mounting; A (0.40); Classified with UL label.
 7. UL Classified Flame Spread: ASTM E 1264; Class A. Product must be able to meet this criteria after being painted six times.
 8. Light Reflectance (LR) White Panel: ASTM E 1477; 0.75.
 9. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.
- C. Substitutions: Not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Site Verification of Conditions:
1. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness that would affect quality and execution of work.
 2. Do not proceed with installation of ceiling system until unacceptable conditions are corrected.
- B. Do not begin installation until materials sufficient to complete an entire room are received and prepared for installation.

3.02 INSTALLATION

- A. Install in accordance manufacturers recommendations and governing regulations, fire resistance rating requirements and industry standards applicable to work.
1. Comply with CISCA (AC).
- B. 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.
- C. Symmetrically locate grid layout in each space. Coordinate work with other trades so that lighting fixtures, grilles and other ceiling fixtures work with grid layout.
- D. Do not use universal splices or other splices that would obstruct passage of recessed lighting fixtures through grid openings or limit fixture relocation upon flanges of ceiling grids.
- E. Support suspension system from structure above, not from ductwork, metal deck, equipment or piping.
- F. Space hangers not more than 6 inches from ends and not more than 4 feet on centers on runners.
- G. Install wall moldings at the perimeter of each acoustical ceiling area and at locations where edge of units would otherwise be exposed.
1. Secure moldings to supporting construction by fastening with screw anchors into the substrate, through holes drilled in vertical leg. Space holes not more than 3 inches from each end and not more than 16 inches on center along each molding.

2. Level moldings with ceiling suspension system, to a level tolerance of 1/8 inch in 12 feet.
 3. Miter corners of moldings accurately to provide hairline joints, securely connected to prevent dislocation. Cope exposed flanges of intersecting suspension system members, so that flange faces will be flush.
 4. Furnish additional tees for supporting grilles, diffusers and light fixtures. Refer to reflected ceiling, HVAC and electrical plans for locations.
 5. Provide reveal edge at walls, other abutting vertical surfaces.
- H. Field paint cut edges to match surface color and sheen.
- I. Arrange acoustical units and orient directionally patterned units, if any, in manner shown on reflected ceiling plans.

3.03 CLEANING

- A. Clean exposed surfaces of acoustical ceilings, trim, edge moldings and suspension members to comply with manufacturer's instructions for cleaning.
- B. Touch up any minor finish damage.
- C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.04 PROTECTION

- A. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that work will be without damage and deterioration at time of acceptance by Owner.

END OF SECTION

**SECTION 09 84 11
WALL-MOUNTED ACOUSTICAL PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall-mounted acoustic panels.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.
- D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available .
- E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
- F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation.
- B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.
- C. Protect panel edges from damage.

1.06 WARRANTY:

- A. Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing.

PART 2 PRODUCTS

2.01 WALL-MOUNTED ACOUSTICAL PANELS

- A. Type AWS-1 & AWS-3 Panel System:
 - 1. Basis-of-Design: Acoufelt Pixel FilaSorb 24; www.acoufelt.com.
 - 2. Materials:

- a. Composition: 100% Polyester.
 - b. Material: FilaSorb.
 3. Module Width: See Section 09 06 02 Materials and Finishes Schedule.
 4. Configuration Pattern: See Section 09 06 02 Materials and Finishes Schedule.
 5. Thickness: 0.94 inches.
 6. Color: As selected from manufacturer's standard colors
 7. Mounting Method: Adhesive.
 8. Properties:
 - a. NRC (ASTM C423): 0.60.
 - b. Fire Test: AS ISO 9705: 2003 Group 1, ASTM E84-17a Class A, ISO 9705: 1993 Group 1.
 - c. Light Fastness: ISO 105-B02 1994, 6-7 .
 9. Environmental Attributes:
 - a. Declare Certification.
 - b. LCB Red List Free.
 - c. Phenol And Formaldehyde Free.
 - d. Low VOC.
 - e. CDPH Compliance
- B. Type: AWS-2 Plank System: 100% Wool Design Felt and Acoustic Substrate.
1. Basis-of-Design: ARO Plank 1 by FilzFelt, www.filzfelt.com/aro-plank-1
 2. Materials:
 - a. Felt: 100% Wool Design Felt, 100 percent biodegradable.
 - b. Acoustic Substrate.
 - c. Contains no formaldehyde, chemical irritants, or harmful substances.
 - d. VOC free.
 3. Module Width: See Section 09 06 02 Materials and Finishes Schedule.
 4. Configuration Pattern: See Section 09 06 02 Materials and Finishes Schedule.
 5. Oreintation: Vertical.
 6. Maximum Plank Length: 9 feet.
 7. Color: As selected from manufacturer's standard colors.
 8. Mounting Method: Interlock Mounting System.
 9. Properties:
 - a. NRC (ASTM C423): 1.00.
 - b. SAA (ASTM C423): 1.00.
 - c. Colorfastness to Light Class: 4-5 (40 hours).
 - d. Colorfastness to Crocking: Class 3-4 (wet), Class 4-5 (dry).
 - e. Environmental: Oeko-Tex Standard 100 Certified Product Class II (100% Wool Design Felt).

2.02 ACCESSORIES

- A. Panel Adhesive: Acceptable to acoustical panel manufacturer for application indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install acoustical panels in locations indicated, following written installation instructions of panel manufacturer. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

3.02 CLEANING

- A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.
- B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

END OF SECTION

**SECTION 09 91 13
EXTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
- 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, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

- A. Specular Gloss: Ranges determined per Master Painters Institute (MPI). Sheen is specified to establish required gloss range.

	Sheen	Geometry/Deg.	Gloss Range	MPI Gloss Level
1.	Flat	60	Below 5	1
2.	Eggshell	60	10 to 25	3
3.	Satin	60	20 to 35	4
4.	Semi-Gloss	60	35 to 70	5
5.	Gloss	60	70 to 85	6
- B. Finish (i.e. gloss level) of painted surfaces shall be as specified herein or as noted on Finish Schedule.

1.03 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- B. SSPC-SP 13 - Surface Preparation of Concrete 2018.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience and approved by manufacturer.

1.06 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Provide door and frame assembly illustrating paint color, texture, and finish.
- C. Locate where directed by Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 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. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Paints:
 1. Benjamin Moore & Co: www.benjaminmoore.com.
 2. Behr Process Corporation: www.behr.com.
 3. PPG Paints: www.ppgpaints.com.

4. Rodda Paint Co. / Cloverdale Paint: www.roddapaint.com.
 5. Sherwin-Williams Company: www.sherwin-williams.com.
 6. Miller Paint; www.millerpaint.com.
- B. Primer Sealers: Same manufacturer as top coats.
- C. Staining and Transparent Finishing: See Section 09 93 00.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete and concrete masonry units.
1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex.
 - a. Concrete Masonry Units Block Filler: latex, interior/exterior.
 - 1) BEHR: Behr Pro Block Filler Primer, 50.
 - 2) Benjamin Moore: Ultra Spec Hi-Build Masonry Block Filler 571.
 - 3) PPG Paints: 6-15 Speedhide Int/Ext Masonry Hi Fill Latex Block Filler.
 - 4) Rodda Paint: Block Filler, 501901.
 - 5) Sherwin-Williams: Pro Industrial Heavy-Duty Block Filler, B42W150.
 - 6) Miller Paint: Kril Int/Ext Block Filler 481011.
 - b. Primer Products: Alkali resistant, water based.
 - 1) BEHR: Premium Plus Multi-Surface Primer, 436.
 - 2) Benjamin Moore: Super Spec 066 Int/Ext 100% Acrylic Masonry Sealer.
 - 3) PPG Paints: 4-603 PERMA-CRETE Interior/Exterior Alkali Resistant Primer.
 - 4) Rodda paint: Prime Solutions First Coat Acrylic Bonding Primer, 501601.
 - 5) Sherwin-Williams: Loxon Concrete and Masonry Primer, LX2W50.
 - 6) Miller Paint: Kril Int/Ext Alkali Resistant Primer 620011.
 - c. Paints Products: Acrylic, GL-5
 - 1) Behr Pro e600 Exterior Semi-Gloss Paint [No.PR670]. (MPI #11)
 - 2) Benjamin Moore: Ultra Spec HP DTM Acrylic, Semi-Gloss HP29.

- 3) PPG Paints Speedhide Exterior Latex Semi-Gloss, 6-900XI Series.
 - 4) Rodda Unique II int/Exterior Acrylic Enamel, Semi Gloss, 542001.
 - 5) Sherwin-Williams: Pro Industrial Acrylic, Semi-Gloss, B66-650 Series.
 - 6) Miller Paint: Kril Exterior Satin 5204XX.
3. Top Coat(s): Exterior High Build Latex, Dry film thickness of not less than 10 mils (0.25 mm).
- a. Primer Products: As recommended in writing by topcoat manufacturer.
 - b. Paint Products: Latex, High build.
 - 1) Behr Premium Exterior High Build Coating No. 4700.
 - 2) Benjamin Moore: Two coats Ultra Spec Masonry Acrylic Latex Satin-Fil 452.
 - 3) PPG Paints Perma-Crete Interior/Exterior Acrylic High Build, 4-22XI Series, Flat.
 - 4) Rodda Paint: pHlex-tite Acrylic Self-Priming Finish, 512301.
 - 5) Sherwin-Williams: Loxon XP, LX11 Series.
4. Top Coat(s): Exterior Pigmented Elastomeric, Water Based.
- a. Block Filler: latex, interior/exterior.
 - 1) BEHR: Behr Pro Block Filler Primer, 50.
 - 2) Benjamin Moore: Ultra Spec Hi-Build Masonry Block Filler 571.
 - 3) PPG Paints: 6-15 Speedhide Int/Ext Masonry Hi Fill Latex Block Filler.
 - 4) Rodda Paint: Block Filler, 501901.
 - 5) Sherwin-Williams: Pro Industrial Heavy-Duty Block Filler, B42W150.
 - 6) Miller Paint: Kril Int/Ext Block Filler 481011.
 - b. Primer Products: As recommended in writing by topcoat manufacturer.
 - c. Products: Elastomeric, Water based.
 - 1) Behr Premium Elastomeric Masonry, Stucco and Brick Paint [No. 68].
 - 2) Dow; DOWSIL ALLGUARD Silicone Elastomeric Coating: www.dow.com/#sle.
 - 3) PPG Paints Perma-Crete Pitt-Flex Elastomeric Coating, 4-110XI Series, Flat. (MPI #113)
 - 4) Rodda Super Roflex Elastomeric Coating, 511301.
 - 5) Sherwin-Williams: Conflex Sherlastic Elastomeric Coating, CF16 Series.
 - 6) Miller Paint: Milastic 15 Elastomeric Coating 5502XX.
- B. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including fiber cement siding.
1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex.
 - a. Primer Products: Alkali resistant, water based.
 - 1) BEHR: Premium Plus Multi-Surface Primer, 436.
 - 2) Benjamin Moore: Super Spec 066 Int/Ext 100% Acrylic Masonry Sealer.
 - 3) PPG Paints: 4-603 PERMA-CRETE Interior/Exterior Alkali Resistant Primer.
 - 4) Rodda Paint: Prime Solutions First Coat Acrylic Bonding Primer, 501601.
 - 5) Sherwin-Williams: Loxon Concrete and Masonry Primer, LX2W50.

- 6) Miller Paint: Kril Int/Ext Alkali Resistant Primer 620011.
- b. Paint Products: Latex, exterior, flat, GL-1.
 - 1) BEHR: Behr Pro e600 Exterior Flat.
 - 2) Benjamin Moore: Ultra Spec Ext Flat Finish N447.
 - 3) PPG Paints 6-610XI Speedhide Exterior Latex Flat.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Flat, 462201
 - 5) Sherwin-Williams: A-100 Acrylic Flat, A6 Series.
 - 6) Miller Paint: Kril Exterior Flat 5201XX.
- c. Paint Products: Latex, exterior, satin, GL-4.
 - 1) BEHR: Behr Pro e600 Exterior Satin, 640.
 - 2) Benjamin Moore: Ultra Spec Ext Satin Finish N448.
 - 3) PPG Paints 6-2045XI Speedhide Exterior Latex Satin.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Satin, 422201.
 - 5) Sherwin-Williams: A-100 Acrylic Satin, A82 Series.
 - 6) Miller Paint: Kril Exterior Satin 5204XX.
- d. Paint Products: Latex, exterior, semi-gloss, GL-5.
 - 1) BEHR: Behr Pro e600 Exterior Semi-Gloss, 670.
 - 2) Benjamin Moore: Ultra Spec Ext Gloss Finish N449.
 - 3) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
 - 4) Rodda Paint: Unique II Int / Exterior Acrylic Enamel Semi Gloss, 542001.
 - 5) Sherwin-Williams: Pro Industrial Acrylic Semi-gloss, B66-650 Series.
 - 6) Miller Paint: Acri Lite Exterior Semigloss 5105XX.
3. Top Coat(s): Exterior High Build Latex, Dry film thickness of not less than 10 mils (0.25 mm).
 - a. Primer Products: As recommended in writing by topcoat manufacturer.
 - b. Paint Products: Latex, High build.
 - 1) Behr Premium Exterior High Build Coating No. 4700.
 - 2) Benjamin Moore: Two coats Ultra Spec Masonry Acrylic Latex Satin-Fil 452.
 - 3) PPG Paints Perma-Crete Exterior Acrylic High Build, 4-22 Series.
 - 4) Rodda Paint: pHlex-tite Acrylic Self-Priming Finish, 512301.
 - 5) Sherwin-Williams: Loxon XP, LX11 Series.
- C. Structural Steel and Metal Fabrications: High Performance Coating:
 1. High Performance Coating, three (3) coat system:
 - a. Applications include exterior exposed metal components, bollards, corner guards, canopies, steel angles, garage gates and items noted to receive High Performance coating.
 - 1) Coating.
 - b. Paint Supplier: Rodda Paint Co.: www.rodmapaint.com.
 - c. Prime coat and shop prime field touch up bare steel:

- 1) Carboline Carbozinc 859 VOC.
 - 2) Sherwin-Williams: Zinc Clad III HS-100, B69-100 Series.
 - d. Intermediate Coat:
 - 1) Carboline Carboguard 890 VOC.
 - 2) Sherwin-Williams: Macropoxy 646-100, B58-600 Series.
 - e. Top Coat:
 - 1) Carbothane 133 MC.
 - 2) Sherwin-Williams: Sherloxane 800, B80-500 Series.
 - f. Thickness, minimum:
 - 1) Prime coat: 3-5 mils DFT.
 - 2) Intermediate coat: 4-6 mils DFT.
 - 3) Color finish coat: 3-5 mils DFT.
 - g. Substitutions: See Section 01 6000 - Product Requirements.
- D. Structural Steel and Metal Fabrications: Alkyd System.
1. Primer Products: Alkyd, anticorrosive, for metal.
 - a. BEHR: Premium Plus Multi-Surface Primer.
 - b. Benjamin Moore: Super Spec Alkyd Metal Primer P06.
 - c. PPG Paints: Devguard 4360 Rust Inhibitive Primer.
 - d. Rodda Paint: Barrier III High Solids Primer, 708225.
 - e. Sherwin-Williams: Kem Bond HS, B50 Series.
 - f. Miller Paint: (PPG) Multiprime DTM Alkyd 4160.
 2. Paint Products: Alkyd, exterior, GL-5.
 - a. BEHR: Oil-Base Interior/Exterior Semi-Gloss Enamel, 3800.
 - b. Benjamin Moore: Super Spec HP Alkyd Semi-Gloss Enamel P24.
 - c. PPG Paints: Devguard 4306 Alkyd Semi-Gloss Enamel.
 - d. Rodda Paint: Marine Maintenance Enamel Semi-Gloss, 749 Series.
 - e. Sherwin-Williams: DTM Alkyd Enamel, B55-100 Series.
 - f. Miller Paint: (PPG)HPC Industrial Enamel Semigloss 4306.
- E. Galvanized-Metal Substrates: Latex System.
1. Primer Products: Primer, galvanized, water based.
 - a. BEHR: Premium Plus Multi-Surface Primer, 436.
 - b. Benjamin Moore: Ultra Spec DTM Acrylic Semi-Gloss Enamel HP29.
 - c. PPG Paints: 90-912 Pitt Tech Plus 100% Acrylic DTM Primer.
 - d. Rodda Cloverdale: EcoLogic Shop Primer, 70323.
 - e. Sherwin-Williams: Pro Industrial ProCryl WB Metal Primer, B66W1310 Series.
 - f. Miller Paint: Acrimetel DTM Low Sheen Primer/Finish 310210.
 2. Paint Products: Latex, exterior, GL-5.
 - a. BEHR: Direct To Metal Semi-Gloss, 3200.
 - b. Benjamin Moore: Ultra Spec DTM Acrylic Semi-Gloss Enamel HP29.
 - c. PPG Paints: Pitt_Tech Plus WB DTM Industrial Enamel, 4216 HP Series, Semi-Gloss.
 - d. Rodda Paint: Multi Master VST Urethane Acrylic DTM Semi Gloss Enamel, 448901.

- e. Sherwin-Williams: Pro Industrial Acrylic Semi-Gloss, B66-650 Series.
 - f. Miller Paint: Acrimetal DTM Semigloss 3105XX.
- F. Aluminum Substrates: Latex System.
- 1. Primer Products: Quick dry, for aluminum.
 - a. BEHR: Premium Plus Multi-Surface Primer.
 - b. Benjamin Moore: Ultra Spec DTM Acrylic Semi-Gloss Enamel HP29.
 - c. PPG Paints: 17-921 Seal Grip Primer.
 - d. Rustoleum: UMA Urethane Modified Acrylic Bonding Primer.
 - e. Sherwin-Williams: Pro Industrial ProCryl WB Metal Primer, B66W1310 Series.
 - 2. Paint Products: Latex, exterior, GL-5.
 - a. BEHR: Direct To Metal Semi-Gloss, 3200.
 - b. Benjamin Moore: Ultra Spec DTM Acrylic Semi-Gloss Enamel HP29.
 - c. PPG Paints: Pitt_Tech Plus WB DTM Industrial Enamel, 4216 HP Series, Semi-Gloss.
 - d. Rodda Paint: Multi Master VST Urethane Acrylic DTM Semi Gloss Enamel, 448901.
 - e. Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series.
 - f. Miller Paint: Acrimetal DTM Low Sheen Primer/Finish 310210.
- G. Stainless-Steel Substrates: Latex System.
- 1. Primer Products: Bonding, solvent based.
 - a. BEHR: Kilz Adhesion Water-Base Bonding Primer, 2111.
 - b. Benjamin Moore: Corotech Waterborne Bonding Primer V175.
 - c. PPG Paints 17-941NF Seal Grip Alkyd Universal Primer.
 - d. Rustoleum: UMA Urethane Modified Acrylic Bonding Primer.
 - e. Sherwin-Williams: DTM Wash Primer, B71Y1.
 - 2. Paint Products: Latex, exterior, GL-5.
 - a. BEHR: Direct To Metal Semi-Gloss, 3200.
 - b. Benjamin Moore: Ultra Spec DTM Acrylic Semi-Gloss Enamel HP2.9.
 - c. PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
 - d. Rodda Paint: Multi Master VST Urethane Acrylic DTM Semi Gloss Enamel, 448901.
 - e. Sherwin-Williams: Pro Industrial Acrylic Semi-Gloss, B66-650 Series.
 - f. Miller Paint: Miller Acri Lite Exterior Semigloss 5105XX.
- H. Wood Substrates: Wood trim, doors, windows, wood board siding, and wood fences.
- 1. Latex over Latex Primer System:
 - a. Primer Products: Latex for exterior wood.
 - 1) BEHR: Premium Plus Multi-Surface Primer, 436.
 - 2) Benjamin Moore: High-Hiding All Purpose Primer 0046.
 - 3) PPG Paints 17-921 Seal Grip Int/Ext Primer.
 - 4) Rodda Paint: Prime Solutions First Coat Bonding Primer, 501601.
 - 5) Sherwin-Williams: Exterior Latex Wood Primer, B42W8141.
 - 6) Miller Paint: All Purpose Stain Blocking Primer 470011.
 - b. Paint Products: Latex, exterior, flat, GL-1.
 - 1) BEHR: Behr Pro e600 Exterior Flat.

- 2) Benjamin Moore: Ultra Spec Ext Flat Finish N447.
 - 3) PPG Paints 6-610XI Speedhide Exterior Latex Flat.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Flat, 462201
 - 5) Sherwin-Williams: A-100 Acrylic Flat, A6 Series.
 - 6) Miller Paint: Kril Exterior Flat 5201XX.
 - c. Paint Products: Latex, exterior, satin, GL-4.
 - 1) BEHR: Behr Pro e600 Exterior Satin, 640.
 - 2) Benjamin Moore: Ultra Spec Ext Satin Finish N448.
 - 3) PPG Paints 6-2045XI Speedhide Exterior Latex Satin.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Satin, 422201.
 - 5) Sherwin-Williams: A-100 Acrylic Satin A82 Series.
 - 6) Miller Paint: Acrinamel Int/Ext Acrylic Enamel Satin 3204XX.
 - d. Paint Products: Latex, exterior, semi-gloss, GL-5.
 - 1) BEHR: Behr Pro e600 Exterior Semi-Gloss, 670.
 - 2) Benjamin Moore: Ultra Spec Ext Gloss Finish N449.
 - 3) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
 - 4) Rodda Paint: Unique II Int / Exterior Acrylic Enamel Semi Gloss, 542001.
 - 5) Sherwin-Williams: Pro Industrial Acrylic Semi-gloss, B66-650 Series.
 - 6) Miller Paint: Acrinamel Int/Ext Acrylic Enamel Semigloss 3205XX.
2. Alkyd System:
- a. Primer Products: Alkyd for exterior wood.
 - 1) BEHR: Premium Plus Multi-Surface Primer.
 - 2) Benjamin Moore: Fresh Start Multi-Purpose Oil-Base Primer 024.
 - 3) PPG Paints 17-941NF Seal Grip Alkyd Primer.
 - 4) Rodda Paint: Prime Solutions Control Primer, 701501.
 - 5) Sherwin-Williams: Exterior Oil Based Wood Primer, Y24W8020.
 - 6) Miller Paint: Alkyd Wood Bond 670011.
 - b. Paint Products: Latex, exterior, flat, GL-1.
 - 1) BEHR: Behr Pro e600 Exterior Flat, 610.
 - 2) Benjamin Moore: Ultra Spec Ext Satin Finish N448.
 - 3) PPG Paints 6-610XI Speedhide Exterior Latex Flat.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Flat, 462201.
 - 5) Sherwin-Williams: A-100 Exterior Acrylic Flat, A6 Series.
 - 6) Miller Paint: Kril Exterior Flat 5201XX.
 - c. Paint Products: Latex, exterior, satin, GL-4.
 - 1) BEHR: Behr Pro e600 Exterior Satin, 640.
 - 2) Benjamin Moore: Ultra Spec Ext Satin Finish N448.
 - 3) PPG Paints 6-2045XI Speedhide Exterior Latex Satin.
 - 4) Rodda Protector XL-100 Exterior Acrylic Latex Velvet Satin, 422201.
 - 5) Sherwin-Williams: A-100 Exterior Acrylic, Satin, A82 Series.
 - 6) Miller Paint: Kril Exterior Satin 5204XX.
 - d. Paint Products: Latex, exterior, semi-gloss, GL-5.
 - 1) BEHR: Behr Pro e600 Exterior Semi-Gloss.

- 2) Benjamin Moore: Ultra Spec Ext Gloss Finish N449.
 - 3) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
 - 4) Rodda Paint: Unique II Int / Exterior Acrylic Enamel Semi Gloss, 542001.
 - 5) Sherwin-Williams: Pro Industrial Acrylic Semi-gloss, B66-650 Series.
 - 6) Miller Paint: Acri Lite Exterior Semigloss 5105XX.
- I. Wood Substrates: Traffic surfaces, including lumber decking and stairs.
1. Latex Porch and Floor Paint over Latex Primer System:
 - a. Primer Products: Latex for exterior wood.
 - 1) BEHR: Premium Plus Multi-Surface Primer.
 - 2) Benjamin Moore: Latex Floor & Patio Low Sheen Enamel N122 thinned.
 - 3) PPG Paints 17-921 Seal Grip Acrylic Primer.
 - 4) Sherwin-Williams: Porch and Floor Enamel, A32-200 Series.
 - 5) Miller Paint: California Paints Allfloor Int/Ext Acrylic Floor Coating 530.
 - b. Paint Products: Latex floor paint, low gloss.
 - 1) BEHR: Porch & Patio Floor Paint, Low-Lustre, 6050.
 - 2) Benjamin Moore: Latex Floor & Patio Low Sheen Enamel N122.
 - 3) PPG Paints 3-510 Floor & Porch 100% Acrylic Satin Latex.
 - 4) Rustoleum: Acrylic Urethane Floor Paint, 5600 System.
 - 5) Sherwin-Williams: Porch and Floor Enamel, A32-200 Series.
 - 6) Miller Paint: California Paints Allfloor Int/Ext Acrylic Floor Coating 530.
 - c. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
 - 1) BEHR: Non-Skid Floor Finish Additive, 970.
 - 2) Rust-Oleum: Anti-Skid Additive.
 - 3) Sherwin-Williams: SharkGrip Slip Resistant Additive
 2. Latex Porch and Floor Paint over Alkyd Primer System:
 - a. Primer Products: Alkyd for exterior wood.
 - b. Paint Products: Latex floor paint, low gloss.
 - 1) PPG Paints 17-941NF Seal Grip Alkyd Primer.
 - 2) Sherwin-Williams: Porch and Floor Enamel, A32-200 Series.
 - 3) Rustoleum: Acrylic Urethane Floor Paint, 5600 System.
 - 4) Miller Paint: California Paints Allfloor Int/Ext Acrylic Floor Coating 530.
 - c. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
- J. Exterior Gypsum Board Substrates:
1. Latex System:
 - a. Primer Products: Latex, exterior.
 - 1) BEHR: Premium Plus Multi-Surface Primer, 436.
 - 2) Benjamin Moore: Insl-X Aqua Lock Plus AQ-0400.
 - 3) PPG Paints 17-921 Seal Grip Acrylic Primer.
 - 4) Rodda Paint: Prime Solutions First Coat Acrylic Bonding Primer, 501601.
 - 5) Sherwin-Williams: PrepRite ProBlock, B51-600 Series.
 - 6) Miller Paint: All Purpose Stain Blocking Primer 470011.

- b. Paint Products: Latex, exterior, flat, GL-1.
 - 1) BEHR: Behr Pro e600 Exterior Flat.
 - 2) Benjamin Moore: Ultra Spec Ext Flat Finish N447.
 - 3) PPG Paints Speedhide Exterior Flat 6-610XI.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Flat, 462201.
 - 5) Sherwin-Williams: A-100 Acrylic Flat, A6 Series.
 - 6) Miller Paint: Kril Exterior Flat 5201XX.
- c. Paint Products: Latex, exterior, satin, GL-4.
 - 1) BEHR: Behr Pro e600 Exterior Satin, 640.
 - 2) Benjamin Moore: Ultra Spec Ext Satin Finish N448.
 - 3) PPG Paints 6-2045XI Speedhide Exterior Latex Satin.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Satin, 422201.
 - 5) Sherwin-Williams: A-100 Acrylic Satin, A82 Series.
 - 6) Miller Paint: Kril Exterior Satin 5204XX.
- d. Paint Products: Latex, exterior, semi-gloss, GL-5.
 - 1) BEHR: Behr Pro e600 Exterior Semi-Gloss, 670.
 - 2) Benjamin Moore: Ultra Spec Ext Satin Finish N448.
 - 3) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
 - 4) Rodda Paint: Unique II Int / Exterior Acrylic Enamel Semi Gloss, 542001.
 - 5) Sherwin-Williams: Pro Industrial Acrylic Semi-gloss, B66-650 Series.
 - 6) Miller Paint: Acri Lite Exterior Semigloss 5105XX.
- e. Paint Products: Latex, exterior, gloss, GL-6.
 - 1) BEHR: Premium Plus Int/Ext Hi-Gloss, 2-8050.
 - 2) Benjamin Moore: Ultra Spec Ext Gloss Finish N449.
 - 3) PPG Paints Speedhide Exterior Gloss 6-8534.
 - 4) Rodda Paint: Unique II Int / Exterior Acrylic Enamel Gloss, 552001.
 - 5) Sherwin-Williams: A-100 Latex Gloss, A8 Series.
 - 6) Miller Paint: Acrimetal DTM Gloss 3106XX.

K. Portland Cement Plaster Substrates:

- 1. Latex System:
 - a. Primer Products: Alkali resistant, water based.
 - 1) BEHR: Premium Plus Multi-Surface Primer.
 - 2) Benjamin Moore: Ultra Spec 608 Int/Ext 100% Acrylic Sealer.
 - 3) PPG Paints; 4-603 PERMA-CRETE® Interior/Exterior Alkali Resistant Primer.
 - 4) Rodda Paint: Prime Solutions First Coat Acrylic Bonding Primer, 501601.
 - 5) Sherwin-Williams: Loxon Concrete and Masonry Primer, LX2W50.
 - 6) Miller Paint: Kril Int/Ext Alkali Resistant Primer 620011.
 - b. Paint Products: Latex, exterior, flat, GL-1.
 - 1) BEHR: Behr Pro e600 Exterior Flat, 610.
 - 2) Benjamin Moore: Ultra Spec Ext Flat Finish N447.
 - 3) PPG Paints 6-610XI Speedhide Exterior Latex Flat.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Flat, 462201.
 - 5) Sherwin-Williams: A-100 Acrylic Flat, A6 Series.

- 6) Miller Paint: Kril Exterior Flat 5201XX.
 - c. Paint Products: Latex, exterior, satin, GL-4.
 - 1) BEHR: Behr Pro e600 Exterior Satin, 640.
 - 2) Benjamin Moore: Ultra Spec Ext Satin Finish N448.
 - 3) PPG Paints 6-2045XI Speedhide Exterior Latex Satin.
 - 4) Rodda Paint: Protector XL-100 Exterior Acrylic Latex Velvet Satin, 422201.
 - 5) Sherwin-Williams: A-100 Acrylic Satin A82 Series.
 - 6) Miller Paint: Kril Exterior Satin 5204XX.
 - d. Paint Products: Latex, exterior, semi gloss, GL-5.
 - 1) BEHR: Behr Pro e600 Exterior Semi-Gloss.
 - 2) Benjamin Moore: Ultra Spec Ext Gloss Finish N449.
 - 3) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
 - 4) Rodda Paint: Unique II Int / Exterior Acrylic Enamel Semi Gloss, 542001.
 - 5) Sherwin-Williams: Pro Industrial Acrylic Semi-gloss, B66-650 Series.
 - 6) Miller Paint: Acri Lite Exterior Semigloss 5105XX.
 2. High-Build Latex System: Dry film thickness of not less than 10 mils (0.25 mm).
 - a. Primer Products: As recommended in writing by topcoat manufacturer.
 - b. Paint Products: Latex, exterior, high build.
 - 1) BEHR: Exterior High Build Coating.
 - 2) Benjamin Moore: Two Coats Ultra Spec Masonry Acrylic Latex Satin-Fil 452 (32g/L).
 - 3) PPG Paints 4-22 Perma-Crete High Build 100% Acrylic Topcoat.
 - 4) Rodda Paint: pHlex-tite Acrylic Self-Priming Finish, 512301.
 - 5) Sherwin-Williams: Loxon XP, LX11 Series.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

- G. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

3.02 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.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.03 COLOR SCHEDULE

END OF SECTION

**SECTION 09 91 23
INTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints and varnishes.
- C. Field application of paints.
- D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
- E. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

- A. Specular Gloss: Ranges determined per Master Painters Institute (MPI). Sheen is specified to establish required gloss range.

	Sheen	Geometry/Deg.	Gloss Range	MPI Gloss Level
1.	Flat	60	Below 5	1
2.	Eggshell	60	10 to 25	3
3.	Satin	60	20 to 35	4
4.	Semi-Gloss	60	35 to 70	5
5.	Gloss	60	70 to 85	6

- B. Finish (i.e. gloss level) of painted surfaces shall be as specified herein or as noted on Finish Schedule.

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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- F. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience and approved by manufacturer.

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 paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Behr Process Corporation: www.behr.com/#sle.
 - 2. Benjamin Moore & Co: www.benjaminmoore.com.
 - 3. PPG Paints: www.ppgpaints.com.
 - 4. Rodda Paint Co: www.roddapaint.com/#sle.
 - 5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 6. Rodda Paint/Cloverdale Paint; www.roddapaint.com.
 - 7. Miler Paint Company; www.millerpaintpro.com.
- C. Primer Sealers: Same manufacturer as top-coats.
- D. Staining and Transparent Finishing: See Section 09 93 00.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
 - 1) Opaque, Flat: 50 g/L, maximum.
 - 2) Opaque, Nonflat: 150 g/L, maximum.
 - 3) Opaque, High Gloss: 250 g/L, maximum.
 - 4) Varnishes: 350 g/L, maximum.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.

- D. Sheens: As indicated on drawings and/or in Section 09 06 02 Materials and Finishes Schedule take precedence over sheens noted in this Section.
- E. Colors: As indicated on drawings and/or in Section 09 06 02 Materials and Finishes Schedule.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Latex.
 - a. Primer Products: Latex, Primer.
 - 1) BEHR: Premium Plus Interior Drywall Primer & Sealer, 73.
 - 2) Benjamin Moore: Ultra Spec® 500 Interior Latex Primer N534.
 - 3) PPG Paints; 6-4900XI Speedhide Interior Latex Sealer Quick Drying.
 - 4) Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 5) Rodda: 403601 Master Painter Zero Interior Primer/Sealer.
 - 6) Miller Paint: Premium PVA Interior Primer 2200011.
 - b. Paint Products for Walls: Acrylic Latex, GL-3
 - 1) BEHR: Behr Pro i300 Interior Eggshell. 330.
 - 2) Benjamin Moore: Ultra Spec® 500 Interior Eggshell Finish N538.
 - 3) PPG Paints: 6-4310XI Speedhide Zero VOC Interior Latex Eggshell.
 - 4) Sherwin-Williams: ProMar 200 Zero VOC Interior Latex EggShell, B20-2600 Series.
 - 5) Rodda: 423601 Master Painter Zero Interior Satin Finish.
 - 6) Miller Paint: Premium Interior Eggshell 1203XX.
 - c. Paint Products for Ceilings: Acrylic Latex, GL-1.
 - 1) BEHR: Behr Pro i100 Interior Flat, 110.
 - 2) Benjamin Moore: Ultra Spec® 500 Interior Flat Finish N536.
 - 3) PPG Paints; 6-4110XI Speedhide Zero VOC Interior Latex Flat.
 - 4) Sherwin-Williams: ProMar 400 Zero VOC Interior Latex Flat, B30-4600 Series.
 - 5) Rodda: 513401 WallPro Flat.
 - 6) Miller Paint: Acro Pure Ultra-Low VOC Interior Flat 110-1-XX.
- B. Top Coat(s): Institutional Low Odor/VOC Interior Latex; Concrete.
 - 1. Primer Products: Alkali-resistant, water based.
 - a. BEHR: Premium Plus All-in-One Primer & Sealer, 75.
 - b. Benjamin Moore: Ultra Spec Masonry 100% Acrylic Sealer 608.
 - c. PPG Paints; 17-921XI Seal Grip Universal Acrylic Primer.
 - d. Sherwin-Williams: Loxon Int/Ext Concrete & Masonry Primer, LX2W50.
 - e. Rodda: 501601 First Coat Interior/Exterior Primer.
 - f. Miller Paint: Kril Primer/Sealer Int/Ext Alkali-Resistant Primer 620011.
 - 2. Paint Products: Acrylic Latex, GL-3
 - a. BEHR: Behr Pro i300 Interior Eggshell, 330.
 - b. Benjamin Moore: Ultra Spec® 500 Interior Eggshell Finish N538.
 - c. PPG Paints Speedhide zero Latex, 6-4310XI Series, Eggshell.
 - d. Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eggshell, B20-2600 Series.

- e. Rodda: 423601 Master Painter Zero Interior Satin Finish.
 - f. Miller Paint: Premium Interior Eggshell 1203XX.
- C. Top Coat(s): Institutional Low Odor/VOC Interior Latex; Wood.
- 1. Primer Products: latex Primer.
 - a. BEHR: Premium Plus All-In-One Primer & Sealer, 75.
 - b. Benjamin Moore: Advance® Waterborne Alkyd Primer 0790.
 - c. PPG Paints; 17-921XI Seal Grip Universal Acrylic Primer.
 - d. Sherwin-Williams PrepRite ProBlock Latex, B51-600 Series.
 - e. Rodda: 502001 Unique Enamel Undercoater.
 - f. Miller Paint: Miller Prime All Purpose Stain Blocking Primer 470011.
 - 2. Paint Products: Acrylic Latex, GL-3
 - a. Behr Pro i300 Interior Eggshell Paint [No.PR330]. (MPI #145)
 - b. Benjamin Moore: Ultra Spec® 500 Interior Eggshell Finish N538.
 - c. PPG Paints Speedhide Zero Interior Latex, 6-4310XI Series, Eggshell.
 - d. Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eggshell, B20-2600 Series.
 - e. Rodda: 523601 Master Painter UL VOC Interior Satin Finish.
 - f. Miller Paint: Premium Interior Eggshell 1203XX.
- D. Top Coat(s): Institutional Low Odor/VOC Interior Latex; Metal.
- 1. Primer Products: Latex primer, rust-inhibitive.
 - a. BEHR: Premium Plus Multi-Surface Primer, 436.
 - b. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04.
 - c. PPG Paints; Pitt-Tech Plus Waterborne Acrylic Primer/Finish 4020PF.
 - d. Sherwin-Williams: Pro Industrial Pro-Cryl Universal Primer, B66W1310.
 - e. Rodda Paint: Ecologic Shop Primer 70323.
 - f. Miller Paint: Acrimetal DTM Int/Ext Velvet Primer/Finish 310210.
 - 2. Paint Products: Acrylic Latex, GL-3
 - a. BEHR: Behr Pro i300 Interior Eggshell, 330.
 - b. Benjamin Moore: Ultra Spec® 500 Interior Eggshell Finish N538.
 - c. PPG Paints Speedhide zero Latex, 6-4310XI Series, Eggshell.
 - d. Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eggshell, B20-2600 Series.
 - e. Rodda: 523601 Master Painter UL VOC Interior Satin Finish.
 - f. Miller Paint: Premium Interior Eggshell 1203XX.
- E. Interior Surfaces to be Painted, Concrete.
- 1. Top Coat(s): Water-Based, Single-component, Epoxy Finish for Concrete:
 - a. Primer Products: Alkali-resistant, water based.
 - 1) BEHR: Premium Plus All-in-One Primer & Sealer, 75.
 - 2) Benjamin Moore: Ultra Spec Masonry 100% Acrylic Sealer 608.
 - 3) PPG Paints; 17-921XI Seal Grip Universal Acrylic Primer.
 - 4) Sherwin-Williams: Loxon Int/Ext Concrete & Masonry Primer, LX2W50.
 - 5) Rodda: 501601 First Coat Interior/Exterior Bonding Primer.
 - 6) Miller Paint: Kril Primer/Sealer Int/Ext Alkali-Resistant Primer 620-0-11.
 - b. Paint Products: Water based, Pre-Catalyzed Epoxy, GL-5.
 - 1) BEHR: Behr Pro Pre-Catalyzed Waterborne Epoxy Semi-Gloss HP150.
 - 2) Benjamin Moore: V341 COROTECH WB Pre-Cat Epoxy Coating Semi-Gloss.

- 3) PPG Paints; 16-510 Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss or 16-310 Eggshell Acrylic Epoxy-self priming.
 - 4) PPG Paints; Amerlock 2 VOC Epoxy.
 - 5) Sherwin-Williams: Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-gloss, K46-1150 Series
 - 6) Rodda: 449001 Protech Pre-Catalyzed Epoxy, Semi Gloss.
 - 7) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
2. Top Coat(s): Water-Based, 2-component, Epoxy Finish for Concrete – Wet Environments
 - a. Primer Products: Alkali-resistant, water based.
 - 1) BEHR: Premium Plus All-in-One Primer & Sealer, 75.
 - 2) Benjamin Moore: Ultra Spec Masonry 100% Acrylic Sealer 608.
 - 3) PPG Paints; 17-921XI Seal Grip Universal Acrylic Primer.
 - 4) Sherwin-Williams: Loxon Int/Ext Concrete & Masonry Primer, LX2W50.
 - 5) Rodda: 501601 First Coat Interior/Exterior Bonding Primer.
 - 6) Miller Paint: Kril Primer/Sealer Int/Ext Alkali-Resistant Primer 620011.
 - b. Paint Products: Water based, 2-component Epoxy, GL-5 or 6.
 - 1) BEHR:
 - 2) Benjamin Moore:
 - 3) PPG Paints; Amerlock 2 VOC Epoxy.
 - 4) Sherwin-Williams Pro Industrial Waterbased Catalyzed Epoxy Gloss, B73-300 Series.
 - 5) Rodda:
 - 6) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
- F. Interior Surfaces to be Painted, CMU
1. Top Coat(s): Water-Based, Single component, Epoxy Finish for CMU:
 - a. Primer Products: Block Filler, Latex.
 - 1) BEHR: Behr Pro Block Filler Primer, 50.
 - 2) Benjamin Moore: Ultra Spec® Masonry Hi-Build Block Filler 571.
 - 3) PPG Paints; 6-15XI Speedhide Hi Fill Latex Block Filler.
 - 4) Sherwin-Williams: Pro Industrial Heavy-Duty Block Filler, B42W150.
 - 5) Rodda: 501901 Block Filler.
 - 6) Miller Paint: Kril Block Filler 481-0-11.
 - b. Paint Products: Water based, Pre-Catalyzed, Epoxy, GL-5.
 - 1) BEHR: Behr Pro Pre-Catalyzed Waterborne Epoxy Semi-Gloss HP150.
 - 2) Benjamin Moore: V341 COROTECH WB Pre-Cat Epoxy Coating Semi-Gloss.
 - 3) PPG Paints; 16-510 Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss or 16-310 Eggshell Acrylic Epoxy-self priming.
 - 4) Sherwin-Williams Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-gloss, K46-1150 Series.
 - 5) Rodda: 449001 Protech Pre-Catalyzed Epoxy, Semi Gloss.
 - 6) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
 2. Top Coat(s): Water-Based, 2-component, Epoxy Finish for CMU – Wet Environments:
 - a. Primer Products: Block Filler, Latex.

- 1) BEHR: Behr Pro Block Filler Primer, 50.
 - 2) Benjamin Moore: Ultra Spec® Masonry Hi-Build Block Filler 571.
 - 3) PPG Paints; 6-15XI Speedhide Hi Fill Latex Block Filler.
 - 4) Sherwin-Williams: Pro Industrial Heavy-Duty Block Filler, B42W150.
 - 5) Rodda: 501901 Block Filler.
 - 6) Miller Paint: Kril Block Filler 481-0-11.
- b. Paint Products: Water-based 2-component Epoxy, GL-5 or 6.
- 1) BEHR:
 - 2) Benjamin Moore:
 - 3) PPG Paints; Amerlock 2 VOC Epoxy.
 - 4) Sherwin-Williams Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series.
 - 5) Rodda: 449001 Protech Pre-Catalyzed Epoxy Semi Gloss.
 - 6) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
- G. Interior Surfaces to be Painted, Gypsum Board.
1. Top Coat(s): Water-Based, Single Component, Epoxy Finish for Walls and Ceilings, Wet Environments:
 - a. Primer Products: As recommended by manufacturer for topcoat.
 - 1) BEHR: Premium Plus Multi-Surface Primer & Sealer 436.
 - 2) Benjamin Moore: Insl-X Aqua Lock Plus AQ-0XXX.
 - 3) PPG Paints; Amerlock 2 VOC Epoxy-self priming.
 - 4) Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 5) Rodda: 501601 Prime Solutions First Coat Bonding Primer.
 - 6) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
 - b. Paint Products: Water based, Pre-Catalyzed, Epoxy, GL-5.
 - 1) BEHR: Behr Pro Pre-Catalyzed Waterborne Epoxy Semi-Gloss HP150.
 - 2) Benjamin Moore: V341 COROTECH WB Pre-Cat Epoxy Coating Semi-Gloss.
 - 3) PPG Paints; 16-510 Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss Acrylic Epoxy-self priming.
 - 4) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-gloss, K46-1150 Series.
 - 5) Rodda: 449001 Protech Pre-Catalyzed Epoxy, Semi Gloss.
 - 6) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
 2. Top Coat(s): Water-Based, 2-component, Epoxy Finish for Walls and Ceilings - Wet Environments:
 - a. Primer Products: as recommended by manufacturer for topcoat.
 - 1) BEHR: Premium Plus Multi-Surface Primer & Sealer 436.
 - 2) Benjamin Moore: Insl-X Aqua Lock Plus AQ-0XXX.
 - 3) PPG Paints; Amerlock 2 VOC Epoxy-self priming.
 - 4) Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 5) Rodda: 501601 Prime Solutions First Coat Bonding Primer.
 - 6) Miller Paint: Premium PVA Interior Primer 220011.
 - b. Paint Products: Water based, 2-component, Epoxy, GL-5 or 6.
 - 1) BEHR:

- 2) Benjamin Moore:
 - 3) PPG Paints; Amerlock 2 VOC Epoxy.
 - 4) Sherwin-Williams Pro Industrial Waterbased Catalyzed Epoxy, B73-300 Series.
 - 5) Rodda: 449001 Protech Pre-Catalyzed Epoxy Semi Gloss.
 - 6) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
- 3.
- H. Medium Metal Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and frames:
1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
 2. Two top coats and one coat primer.
 3. Interior Epoxy-Modified Latex; Single Component.
 - a. Primer Products: Latex primer, rust-inhibitive.
 - 1) BEHR: Premium Plus Multi-Surface Primer, 436.
 - 2) Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04.
 - 3) PPG Paints; Pitt-Tech Plus Waterborne Acrylic Primer/Finish 4020PF.
 - 4) Sherwin-Williams: Pro Industrial Pro-Cryl Universal Primer, B66W1310.
 - 5) Rodda: 70323 EcoLogic Shop Primer.
 - 6) Miller Paint: Acrimetal DTM Int/Ext Velvet Primer/Finish 310-2-10.
 - b. Paint Products: Epoxy-Modified Latex, Pre-Catalyzed, GL-5.
 - 1) BEHR: Behr Pro Pre-Catalyzed Waterborne Epoxy Semi-Gloss HP150.
 - 2) Benjamin Moore: V341 COROTECH WB Pre-Cat Epoxy Coating Semi-Gloss.
 - 3) PPG Paints; 16-510 Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss or 16-310 Eggshell Acrylic Epoxy-self priming.
 - 4) Sherwin-Williams: Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-gloss, K46-1150 Series.
 - 5) Rodda: 449001 Protech Pre-Catalyzed Epoxy, Semi Gloss.
 - 6) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
- I. Medium Duty Vertical and Overhead: Including shop primed steel, galvanized steel, and aluminum.
1. Two top coats and one coat primer.
 2. Primer Products:
 - a. BEHR: Premium Plus Multi-Surface Primer, 436.
 - b. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04.
 - c. PPG Paints; Pitt-Tech Plus Waterborne Acrylic Primer/Finish 4020PF.
 - d. Sherwin-Williams: Pro Industrial Pro-Cryl Universal Primer, B66-310.
 - e. Rodda: 70323 EcoLogic Shop Primer.
 - f. Miller Paint: Acrimetal DTM Int/Ext Velvet Primer/Finish 310-2-10.
 3. Paint Products: Water-based Enamel.
 - a. BEHR: Direct To Metal Semi-Gloss, 3200.
 - b. Benjamin Moore: Ultra Spec HP® D.T.M. Acrylic Low Lustre Enamel HP25.
 - c. PPG Paints; Break Through Water-Borne Acrylic Satin V51-410.
 - d. Sherwin-Williams: Pro Industrial High Performance Acrylic EggShell, B66-660.

- e. Rodda: 438901 Multi Master VST Urethane Acrylic DTM Enamel Satin.
 - f. Miller Paint: Acrimetel DTM Int/Ext Acrylic Semi Gloss 310-5-XX.
- J. Medium Wood Door/Trim: For surfaces subject to frequent contact by occupants, including wood:
- 1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
 - 2. Two top coats and one coat primer.
 - 3. Interior Epoxy-Modified Latex; Single component.
 - a. Primer Products: Latex Primer
 - 1) BEHR: Premium Plus All-In-One Primer & Sealer, 75.
 - 2) Benjamin Moore: Advance® Waterborne Alkyd Primer 0790.
 - 3) PPG Paints; 17-921XI Seal Grip Universal Acrylic Primer.
 - 4) Sherwin-Williams PrepRite ProBlock Latex, B51-600 Series.
 - 5) Rodda: 502001 Unique Enamel Undercoater.
 - 6) Miller Paint: Miller Prime All Purpose Stain Blocking Primer 470-0-11.
 - b. Paint Products: Epoxy-Modified Latex, Pre-Catalyzed, GL-5
 - 1) BEHR: Behr Pro Pre-Catalyzed Waterborne Epoxy Semi-Gloss HP150.
 - 2) Benjamin Moore: V341 COROTECH WB Pre-Cat Epoxy Coating Semi-Gloss.
 - 3) PPG Paints; 16-510 Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss or 16-310 Eggshell Acrylic Epoxy-self priming.
 - 4) Sherwin-Williams: Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-gloss, K46-1150 Series.
 - 5) Rodda: 449001 Protech Pre-Catalyzed Epoxy, Semi Gloss.
 - 6) Miller Paint: Waterborne Epoxy Interior Semi Gloss 183-5-10.
- K. Transparent Finish on Wood, Clear Class A Fire Retardant Varnish.
- 1. 2 top coats, no stain.
 - 2. Fire-Resistive Coating System: Water-based, asbestos-free, factory-mixed thin film intumescent coating system with smooth and uniform finish texture.
 - 3. Thickness: Dry mil thickness in accordance with acceptable test data for substrate.
 - 4. Surface Burning Characteristics, when tested in accordance with ASTM E84, Class A:
 - a. Flame Spread Index: 25, maximum.
 - b. Smoke Developed Index: 50, maximum.
 - 5. Product(s):
 - a. Basis of Design: Universal Fire Shield LLC; Product FireKote 100: www.firechemicals.com.
 - b. Fire Retardants, Inc.; Product Burn Barrier 166 Clear A - Fire Retardant Intumescent Varnish: www.fireretardantsinc.com.
 - c. RDR Technologies; Product FX Flame Guard Clear Top Coat Fire Retardant: www.fireoff.com.
 - d. Substitutions: See Section 016000 - Product Requirements.
- L. Smoke Containment System and Elevator Doors, if painted:
- 1. Contact smoke containment manufacture prior to initiating any painting of system or its components.

- a. Field painting of hoistway door frames, and auxiliary rails will require stripping of existing paint to base metal and repainting with a sprayed 0.005 inch thick maximum paint resistant to 400°F.
 - b. Use Valspar Hi-heat silicone coatings or Sherwin Williams Flame Control TemperKote 850 Series or smoke containment system manufacturer approved alternate.
- M. Gypsum Board/Plaster, Vapor Retarder Primer:
1. Applications include walls, ceilings, and soffits as part of building vapor barrier.
 2. Perm Rating: Less than 1 perm per ASTM E96/E96M.
 3. Products:
 - a. Benjamin Moore & Co; Product Moorcraft Super Spec
260: www.benjaminmoore.com.
 - b. PPG Paints: Seal Grip Perm Sealer Vapor Barrier Primer 17-9801.
 - c. Sherwin Williams Company; Product Moisture Vapor Barrier Primer/Sealer, B72W11.
 - d. Rodda: 507901 Vapor Block.
 - e. Miller Paint: Vapor Lok Interior Vapor Barrier Primer 271011.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- F. Galvanized Surfaces:
- G. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- H. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- I. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.02 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

END OF SECTION

**SECTION 10 14 00
SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cash allowance for signs.
- B. Room and door signs.
- C. Emergency evacuation maps.
- D. Building identification signs.
- E. Fire Wall Signage.
- F. Access

1.02 PRICE AND PAYMENT PROCEDURES

- A. See Section 01 21 00 - Allowances, for cash allowances affecting this section.
- B. Allowance amount covers purchase and delivery but not installation.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Verification Samples: Submit samples showing colors specified.
- D. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Store tape adhesive at normal room temperature.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS

- A. All Signage Types: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - 2. Character Case: Upper case only.
 - 3. Background Color: Clear.
 - 4. Character Color: Contrasting color.

5. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
6. Sign Type: Flat signs with engraved panel media.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 1. Stairs: Identify stairs at each level with floor number, direction of travel, access to roof and braille.
 - a. Stair sign to comply Building Code requirements.
- C. Occupant load Signage:
 1. Sign Type: Same as room and door signs.
 2. Sign to comply Building Code and Fire Code requirements.
 3. Post Occupant loads as approved by Fire Marshall.
 4. Provide for each Assembly Occupancies (Type A).
- D. Emergency Evacuation Maps: A diagram depicting two evacuation routes to building exits.
 1. Allow for one map per Unit egress door.
 2. Comply Building Code and Fire Code requirements.
 3. Map content to be provided by Owner.
 4. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.
- E. Building Identification Signs:
 1. Use individual metal letters.
 2. Mount on outside wall in location indicated on drawings.
 3. See Electrical drawings for design.
- F. Identification of Fire and Smoke Assemblies:
 1. Application: Identification for fire barriers and fire partitions.
 2. Character Height: 3 inch with 3/8 inch strokes.
 3. Code Compliant Text: FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS.
 4. Spacing: 15 feet from end of wall and 30 feet on center, maximum.
 5. Sign Type: Flat sign or stencil permanently attached or adhered to wall.
 6. Location: Accessible concealed floor, floor/ceiling or attic spaces for any rated or smoke wall.

2.02 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 1. Edges: Square.
 2. Corners: Square.
- B. Color and Font: Unless otherwise indicated:
 1. Character Font: Helvetica, Arial, or other sans serif font.
 2. Character Case: Upper case only.
 3. Background Color: Clear.
 4. Character Color: Contrasting color.

2.03 ACCESSIBLE PARKING STALL SIGN

- A. Parking Stall Signage:

1. Design: Required by jurisdiction having authority.
 2. Size: Vertical rectangle of standard size of 12 x 18 inches.
 3. White retroreflective sheeting background with green text and white symbol on blue
 4. Mounting Height: Required by jurisdiction having authority.
- B. Van Accessible Signage:
1. Design: Required by jurisdiction having authority.
 2. Size: Horizontal rectangle - 9" x 18".
 3. White retroreflective sheeting background with green text and white symbol on blue.
 4. Mounting Height: Required by jurisdiction having authority.
 5. Where greater than four Van Accessible spaces are provided, install additional signs in each stall with the following: WHEELCHAIR USER ONLY. Size and color to match Van Accessible sign.
- C. Accessible Bicycle Parking Signage:
1. Design: International Symbol of Accessibility.
 2. Size: 6 x 6 inches.
 3. Legend and border to be white on blue background.
 4. Mounting Height: 60 inches.
- D. Post:
1. Galvanized steel.
 2. Size: Nominal 2 inch diameter.
 3. Length: As required.

2.04 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/16 inch.

2.05 NON-TACTILE SIGNAGE MEDIA

- A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
1. Sign Color: Clear.
 2. Total Thickness: 1/8 inch.

2.06 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate work of this Section with Electrical Contractor.

- C. Install neatly, with horizontal edges level.
- D. Locate signs and mount at heights indicated on drawings and in accordance with ICC A117.1, ADA Standards, and applicable building codes.
- E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

**SECTION 10 23 10
GLAZED INTERIOR WALL AND DOOR ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Framed glazed interior wall and door assemblies.

1.02 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- F. ASTM C1036 - Standard Specification for Flat Glass 2021.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- I. ASTM E413 - Classification for Rating Sound Insulation 2022.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each component in partition assembly.
- C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
 - 1. Include field measurements of openings.
 - 2. Include Elevations Showing:
 - a. Locations and identification of manufacturer-supplied door hardware and fittings.
 - b. Locations and sizes of cut-outs and drilled holes for other door hardware.
 - 3. Include Details Showing:
 - a. Requirements for support and bracing of overhead track.
 - b. Installation details.
 - c. Appearance of manufacturer-supplied door hardware and fittings.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Specimen Warranty.

- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until installation.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against excessive degradation of metal finishes. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN - FRAMED GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

- A. Basis of Design: Tagwall; www.tagwall.com.

2.02 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide glass partitions and door assemblies tested by qualified testing agency, calculated in accordance with ASTM E413, tested in accordance with ASTM E90, and rated for not less than Sound Transmission Class (STC) indicated.
 - 1. Partition STC Rating: 35, minimum, for framed partition.

2.03 FRAMED GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

- A. Framed Glazed Interior Wall Assembly: Factory fabricated assemblies consisting of center-glazed perimeter channel frames, butt-glazed dry joints and framed joints between panels.
 - 1. Application: Residential Buildings 1, 2, & 3.
 - 2. Configuration: As indicated on drawings.
 - 3. Frame Finish: Pigmented organic coatings.
 - a. Color: Black - RAL 9005 .
 - 4. Coordinate wall and door assembly preparation and provide hardware as necessary for fully operable installation.
 - 5. Design system to withstand normal operation without damage, racking, sagging, or deflection.
 - 6. Factory assembled to greatest extent practical; may be disassembled to accommodate shipping constraints.
 - 7. Manufacturer:

- a. Basis of Design: Tagwall; Industrial Sash System; www.tagwall.com.
- B. Framed Glazed Interior Wall Assembly: Factory fabricated assemblies consisting of perimeter channel frames, and framed joints between panels.
 1. Application: Amenity Building 4.
 2. Configuration: As indicated on drawings.
 3. Head Channel Frame: 3 inch wide by 4-1/8 inch deep.
 4. Jamb Channel Frame: 1-3/4 inch wide by 4-1/8 inch deep.
 5. Frame Finish: Pigmented organic coatings.
 - a. Color: Rift White Oak.
 6. Perimeter Anchors: Aluminum.
 7. Coordinate wall and door assembly preparation and provide hardware as necessary for fully operable installation.
 8. Design system to withstand normal operation without damage, racking, sagging, or deflection.
 9. Factory assembled to greatest extent practical; may be disassembled to accommodate shipping constraints.
 10. Manufacturer:
 - a. Basis of Design: Tagwall; Rowan System; www.tagwall.com.
- C. Sliding Glass Doors: Top supported from roller assembly inside head channel frame.
 1. Application: Residential Buildings 1, 2, 3, & Amenity Building 4.
 2. Door Configuration: As indicated on drawings.
 3. Door Weight: 300 lbs, maximum.
 4. Glass Thickness: 1/2 inch, tempered.
 5. Door Hardware: Ladder pulls, 1 inch diameter solid aluminum with 2-1/2 inch projection at lock stile.
 - a. Finish: Anodized Black.
 6. Provide accessories as required for complete installation.
 7. Product: Tagwall; Encore & Rowan System Framed Sliding Door .
- D. Pivoting Aluminum Doors: Fully framed aluminum doors, alloy 6063, T5 temper, extruded aluminum.
 1. Application: Residential Buildings 1, 2, 3 & Amenity Building 4.
 2. Door Configuration: As indicated on drawings.
 3. Door Width: As scheduled.
 4. Door Height: As scheduled.
 5. Stile Width: 3-1/2 inch.
 6. Top Rail Height: 1-1/2 inch.
 7. Bottom Rail Height: 3-1/2 inch.
 8. Glazing Infill: 1/2 inch.
 9. Finish: Varies by location see schedule-drawings.
 10. Door Hardware: Ladder pulls, 1 inch diameter solid aluminum with 2-1/2 inch projection at lock stile.
 - a. Finish: Anodized Black.
 11. Provide accessories as required for complete installation.

2.04 MATERIALS

- A. Glass: Flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, Class 2 - Tinted, Quality Q3, fully tempered in accordance with ASTM C1048, Kind FT, and as follows:
 - 1. Thickness: 1/2 inch.
 - 2. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.
- B. Aluminum Components: Complying with ASTM B221 (ASTM B221M), alloy 6063, T5 temper.
- C. Sealant: One-part silicone sealant, complying with ASTM C920, clear.

2.05 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.
- B. Color: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that track supports are properly braced, level within 1/4 inch of required position and parallel to the floor surface.
- B. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.
- C. Do not begin installation until supports and adjacent substrates have been properly prepared.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean substrates thoroughly prior to installation.
- B. Prepare substrates using the methods recommended by the manufacturer for achieving acceptable result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with glazed interior wall and door assembly manufacturer's instructions.
- B. Fit and align glazed interior wall and door assembly level and plumb.

3.04 ADJUSTING

- A. Adjust glazed interior wall and door assembly to operate smoothly from sliding or pivoting positions.

3.05 CLEANING

- A. Remove protective film from exposed metal surfaces.
- B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or

other substances that may damage the material or finish.

- C. Glass and Glazing: Clean glazing surfaces; remove excess glazing sealant compounds, dirt, and other substances.
- D. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

**SECTION 10 26 00
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.
- B. Protective wall covering.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Corner guards fabricated from rolled metal sections or bent plate.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2023, with Editorial Revision.
- 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 2023.
- D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies 2023.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
- D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- E. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Protective Corridor Handrails and Corner Guards:
 - 1. Babcock-Davis: www.babcockdavis.com/#sle.
 - 2. Construction Specialties, Inc; Acrovyn Solid Color and Chameleon Crash Rails: www.c-sgroup.com/#sle.
 - 3. Inpro: www.inprocorp.com/#sle.
 - 4. Koroseal Interior Products: www.koroseal.com/#sle.
 - 5. Nystrom, Inc: www.nystrom.com/#sle.
 - 6. Trim-Tex, Inc: www.trim-tex.com/#sle.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

- A. Corner Guards - Flush Mounted: Rigid vinyl drywall corner bead with semi-rigid vinyl corner guard.
 - 1. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 2. Corner: 90 degrees.
 - 3. Color: As selected from manufacturer's standard colors.
- B. Corner Guards - Surface Mounted:
 - 1. Corner guards fabricated from rolled section or bent plate are specified in Section 05 50 00.
 - 2. Material: High impact vinyl with full height extruded aluminum retainer.
 - 3. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
 - 4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 5. Width of Wings: 2 inches.
 - 6. Corner: Square.
 - 7. Color: As selected from manufacturer's standard colors.
 - 8. Length: One piece.
- C. Corner Guards - Surface Mounted, Transparent Plastic:

1. Material: Clear polycarbonate, extruded.
 2. Thickness: 0.075 inch.
 3. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
 4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 5. Width of Wings: 2-1/2 inches, with radiused corner and rounded wing tips.
 6. Corner Angle: 90 degrees.
 7. Length: One piece, 48 inches.
- D. Protective Wall Covering: Type WP-1.
1. Material: Polyvinyl chloride, polyester/cotton blend woven backing, adhesives and pigments including a rigid vinyl laminate and a polyvinyl fluoride cap film.
 2. Thickness: 0.030 inch.
 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 10 and smoke developed index of 120, when tested in accordance with ASTM E84.
 4. Color and Pattern: See Section 09 06 02 Materials and Finishes Schedule.
 5. Manufacturer:
 - a. See Section 09 06 02 Materials and Finishes Schedule

2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to 48 inches high.

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.

END OF SECTION

**SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Residential toilet, shower, and bath accessories.
- C. Under-lavatory pipe supply covers.
- D. Utility room accessories.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.
- C. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings 2022.
- D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017 (Reapproved 2022).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. Taymor Industries LTD; taymor.com.
 - 2. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 3. Bobrick Washroom Equipment, Inc.; www.bobrick.com
 - 4. Liberty Hardware Mfg. Corp.; Product Franklin Brass series; www.libertyhardware.com/brands/franklin_brass.
 - 5. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- C. Zinc Alloy: Die cast, ASTM B86.
- D. Adhesive: Two component epoxy type, waterproof.

- E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

2.04 AMENITY AND UNIT TOILET AND BATH ACCESSORIES

- A. Refer to Toilet and Bath Accessory Schedule on drawings.

2.05 RESIDENTIAL SHOWER AND TUB ACCESSORIES

- A. Refer to Toilet and Bath Accessory Schedule on drawings.

2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers:
 - 1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
 - 2. Products:
 - a. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx:
www.plumberex.com/#sle.

2.07 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
 - 1. Holders: Three spring-loaded rubber cam holders.
 - 2. Length: 36 inches.
 - 3. Products:

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 location of backing or blocking for attachment of grab bars.

3.02 PREPARATION

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. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 - 1. Grab Bars: As indicated on drawings.
 - 2. Other Accessories: As indicated on drawings.

END OF SECTION

**SECTION 10 31 00
MANUFACTURED FIREPLACES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured steel box fireplace.
- B. Accessories, including precast hearth, circulating fan.

1.02 REFERENCE STANDARDS

- A. UL (DIR) - Online Certifications Directory Current Edition.
- B. UL 127 - Standard for Factory-Built Fireplaces Current Edition, Including All Revisions.

1.03 SYSTEM DESCRIPTION

- A. Built-in electric water mist fireplace.

1.04 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide fire box cabinet dimensions, clearances required from adjacent dissimilar construction, applicable regulatory agency approvals, electrical characteristics of fan.
- C. Shop Drawings: Indicate fire box rough opening dimensions, rough opening sizes for flue, and fan size and vent duct layout, including require clearances to combustible surfaces, maximum duct run, maximum number of elbows and opening.

1.05 DOCUMENTATION FOR SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for site information:
 - 1. Installer Qualifications.
 - 2. Manufacturer's field reports.
 - 3. Manufacturer's Certificate: Certify that fireplace components meet or exceed UL (DIR) and CSA requirements.
 - 4. Manufacturer's Instructions: Indicate installation procedures and component installation sequence, clearances and tolerances from adjacent construction.
 - 5. Coordination Drawings.
 - 6. Other types indicated.
- D. Documentation for Site Information maybe reviewed by Architect for reference.

1.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and Maintenance Data.
 - 3. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 4. Submittals for Site information.
 - 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 2 year experience installing similar products.

1.08 WARRANTY

- A. Warranty: Manufacturer's standard commercial warranty against defects in materials and workmanship. Labor, 1 year and firebox and heat exchanger/burner, 10 year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufactured Fireplaces:
 - 1. See Interior Drawings Equipment and Finish Schedule.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable code for clearances from adjacent materials, chimney height above roof line requirements, and unit UL approval.
- B. Listed by Underwriters Laboratories Inc. (UL) as complying with UL 127.
- C. Products Requiring Electrical Connection: Listed and labeled by UL (DIR) or testing firm acceptable to authorities having jurisdiction, as suitable for the purpose specified and indicated.

2.03 FIREPLACE - GENERAL CHARACTERISTICS

- A. Provide fireplace with the following construction with size, accessories and performance as specified:
 - 1. Configuration: Single Sided.
 - 2. Firebox: Linear Burner
 - 3. Location: Indoor.
 - 4. Power Vent: Inline.

2.04 COMPONENTS

- A. Fire Box: Formed insulated steel cabinet, rectangular shaped interior, configured to include chimney outlet and cleanout, front air inlet and integral air outlet.
 - 1. Air Jacket: Steel enclosure surrounding fire box, air inlets and outlets, electrical fan with on/off switch.
 - 2. BTU Rating: 4,981.
 - 3. Wiring: Direct-wire.
 - 4. Voltage: 120V.
 - 5. Wattage: 1,460 W.
 - 6. Supplemental Heating: Fan-forced heater.
- B. Exposed Cladding: Prepainted steel.
- C. Fire Box Closure: Clear, tempered glass doors in black steel frame, butt hinged, with friction catch.
- D. Plumbing Kit: Plumbed water supply kit that provides continuous operation. Coordinate with Mechanical.

2.05 FACTORY FINISHING

- A. Exposed to View Surfaces: Baked enamel, black color.

2.06 ACCESSORIES

- A. Precast Hearth: See Section 09 06 02 Materials and Finishes Schedule.
- B. Controls: Sight and Sound Remote.
- C. Fire Box Media:
 - 1. Black Rock Kit.
- D. Circulating Fans: Motor and fan, UL approved, 120 volts with remote on/off switch, sheet steel enclosure, and face grille.
- E. Fasteners and Anchors: Galvanized steel type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that prepared openings are ready to receive work and opening dimensions are as indicated on drawings.
- B. Verify that proper power supply and fuel source are available.

3.02 INSTALLATION

- A. Install unit assembly in accordance with manufacturer's written instructions, requirements of authorities having jurisdiction, and UL requirements. Use manufacturer's guidelines for minimum clearances to combustibles, walls, and finishes. Anchor all components firmly in position.
- B. Carefully cut holes for fan wall switch and grilles.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation, visually inspect all exposed surfaces. Touch up scratches and abrasions with touch-up paint recommended by the manufacturer, make imperfections invisible to the unaided eye.
- B. Manufacturer's Representative to test and approve for proper operation, control and safety devices.
- C. Complete Installer's Warranty Validation Card.

3.04 TOLERANCES

- A. Maximum Variation of Chimney From Plumb: 1/2 inch.

END OF SECTION

**SECTION 10 44 00
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.03 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10.
- B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 3. Nystrom, Inc: www.nystrom.com.
 - 4. Potter-Roemer: www.potterroemer.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fire Extinguisher Cabinets and Accessories:

1. Basis of Design: Activar Construction Products Group - JL Industries:
www.activarcpg.com/#sle.
 - a. Fire Rated Cabinets: Academy Series-Aluminum, FX2
 - b. Non-fire Rated Cabinets: Academy Series-Aluminum.
2. Kidde, a unit of United Technologies Corp: www.kidde.com.
3. Nystrom, Inc: www.nystrom.com.
4. Potter-Roemer: www.potterroemer.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 1. Class: A:B:C type.
 2. Size: 10 pound.
 3. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

- A. Cabinet Configuration: Semi-recessed type.
 1. Size to accommodate accessories.
 2. Projected Trim: Returned to wall surface, with ___ inch projection, and ___ inch wide face.
- B. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- C. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- E. Fabrication: Weld, fill, and grind components smooth.
- F. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.
- G. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.
 1. Color: Red.
 2. Application:
 - a. Elevator Equipment Room.
- B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, ____ inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

END OF SECTION

**SECTION 10 51 13
METAL LOCKERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers.

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 FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.
- C. Shop Drawings: Indicate locker plan layout, elevation views, dimensions, details of wall, floor, and ceiling interface, door swings, and numbering plan.

1.04 DOCUMENTATION FOR SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Documentation for Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for site information:
 - 1. Manufacturer's Installation Instructions: Indicate component installation assembly.
 - 2. Other types indicated.
- D. Documentation for Site Information maybe reviewed by Architect for reference.

1.05 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and Maintenance Data.
 - 3. Submittals for Site information.
 - 4. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lockers:
 - 1. Penco Products, Inc; Vanguard, knock-down lockers: www.pencoproducts.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOCKER APPLICATIONS

- A. Maker Space: Metal lockers, free-standing with standard legs.
 - 1. Width: 15 inch.
 - 2. Depth: 15 inches.
 - 3. Height: 72 inches.
 - 4. Configuration: Four tier.
 - 5. Fittings: Size and configuration as indicated on drawings.
 - a. Hooks: One single prong.
 - b. Friction catch.
 - 6. Ventilation: Perforated side panels and doors.
 - 7. Locking: Padlock hasp, for lock provided by tenant.
 - a. Locking Action: Positive, automatic type, whereby locker may be locked when open, then closed without unlocking.
 - 8. Provide sloped top.
 - 9. Color: To be selected from manufacturer's full range by Architect.
 - 10. Color: Manufacturer's Color _____.
- B. Bike Storage Room: Metal lockers, free-standing with standard legs.
 - 1. Width: ____ inch.
 - 2. Depth: 15 inches.
 - 3. Height: 72 inches.
 - 4. Configuration: Five tier.
 - 5. Fittings: Size and configuration as indicated on drawings.
 - a. Upper shelf.
 - b. Hooks: One double prong.
 - c. Friction catch.
 - 6. Ventilation: Provide louvered doors in manufacturer's standard louver pattern.
 - 7. Locking: Padlock hasp, for lock provided by tenant.
 - 8. Provide sloped top.
 - 9. Color: To be selected from manufacturer's full range by Architect.

2.03 METAL LOCKERS

- A. Accessibility: Design units indicated on drawings as 'accessible' to comply with ICC A117.1 and ADA Standards.
- B. Locker Case Construction:
 - 1. Standard-Duty, Knocked Down Construction: Made of formed sheet steel; metal edges finished smooth without burrs; baked enamel finished inside and out.

- a. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
 - 1) Body and Shelves: 24 gauge, 0.0239 inch.
 - 2) Backs: 24 gauge, 0.0239 inch.
 - 3) Legs: Manufacturer's standard.
 - (a) Height: 6 inches.
- C. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.
 - 1. Door Thickness: 16 gauge, 0.0598 inch, minimum.
 - 2. Form recess for operating handle and locking device.
- D. Latches and Door Handles: Manufacturer's standard.
 - 1. Latching: Manufacturer's standard for locking arrangement selected.
- E. Sloped Top: 20 gauge, 0.0359 inch, with closed ends.
- F. Trim: 20 gauge, 0.0359 inch.
- G. Number Plates: Provide oval shaped aluminum plates. Form numbers 1 inch high of block font style with ADA designation, in contrasting color.
- H. Locks: Locker manufacturer's standard type indicated in Applications article above.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Install fittings if not factory installed.
- D. Replace components that do not operate smoothly.

END OF SECTIONIKE

**SECTION 10 55 00
POSTAL SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Central mail delivery boxes.

1.02 REFERENCE STANDARDS

- A. 39 CFR 111 - U.S. Postal Service Standard 4C Current Edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, maintenance information, and current USPS approval documentation.
- C. Shop Drawings: Indicate plans for each unit or groups of units, front elevations with compartment layout and model number, overall dimensions, rough-in opening sizes, construction and anchorage details.
- D. Warranty: Submit manufacturer sample warranty.

1.04 PROJECT CONDITIONS

- A. Verify that field measurements are as indicated.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty against defects in materials or workmanship for a period of 5 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CENTRAL MAIL DELIVERY BOXES

- A. Central Mail Delivery Boxes: Provide products approved for United States Postal Service (USPS) delivery.
 - 1. Materials: Aluminum with stainless steel hardware.
 - 2. Finish: Powder coat in color selected by Architect from manufacturer's standard colors.
 - 3. Unit Types and Sizes: As indicated on drawings.
 - 4. Configurations: See drawings for overall dimensions and layouts.
- B. Wall-Mounted Mailboxes: Fully-recessed, complying with 39 CFR 111 (USPS-STD-4C).
 - 1. Front-loading with master door, double-column design, 9 customer compartments, 1 outgoing mail compartment, and two parcel compartments.
 - a. Basis of Design: Florence Manufacturing Company; Model 4CADD-09CS.
 - 1) Dimensions: 31 9/16 inches by 37 1/4 inches high by 17 inches deep.

2.02 COMPONENTS

- A. Box Sizes: Configured as follows:
 - 1. Size 4C: 3 x 12 x 15 inches (H x W x D), minimum inside clear dimension, meeting USPS-STD-4C specification.
- B. "Out-Going Mail" Lock Box: Face plate to match front loading panel frame, box of galvanized steel construction, 3 x 12 x 15 inch size (H x W x D), lockable with cylinder provided by Post Office.
- C. "Parcel Compartment" Lock Boxes: Face plate to match front loading panel frame, box of galvanized steel construction, 15 x 12 x 15 inch size (H x W x D), lockable with cylinder provided by Post Office.
- D. Locking - Front Loading Master Door: Three-point latching mechanism with USPS master lock furnished and installed by postmaster.
- E. Locking - Customer Compartment Doors: USPS approved cam lock, 3 keys each lock.
- F. Locking - Parcel Compartment Doors: Double-lock arrangement with USPS approved cam lock for customer access, and USPS master lock furnished and installed by postmaster.
- G. Identification - Customer and Parcel Compartments: Sequential numerical or alphabetic characters, top to bottom, left to right; factory-installed.
 - 1. Numerical order, as reviewed by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough-openings are ready to receive wall-mounted units.
- B. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

- A. Install postal specialties in accordance with approved shop drawings, manufacturer's instructions, and USPS requirements.
- B. Adjust and lubricate door hardware to operate properly.

END OF SECTION

**SECTION 10 56 13
METAL STORAGE SHELVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Four post shelving.
- B. Case type shelving.
- C. Case type cabinets.
- D. Case type desks.
- E. Cantilevered shelving.
- F. Shelving accessories.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Rated uniform shelf loads.
 - 2. Details of shelving assemblies, including reinforcement.
 - 3. Accessories.
- C. Shop Drawings: Indicate location, type, and layout of shelving, including lengths, heights, and aisle layout, and relationship to adjacent construction.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and finishes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Four Post Shelving:
 - 1. Hallowell; _____: www.hallowell-list.com/#sle.
 - 2. List Industries, Inc; _____: www.listindustries.com/#sle.
 - 3. Montel; SmartShelf: www.montel.com/#sle.
 - 4. SpaceSaver Corporation; _____: www.spacesaver.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Case Type Shelving:
- C. Cantilevered Shelving:

2.02 SHELVING - GENERAL

- A. See drawings for layout and sizes.
- B. Seismic Design: Design for Seismic Zone 3, in accordance with ASCE 7, Section 9.

2.03 FOUR POST SHELVING

- A. Four Post Shelving: Steel post-and-beam type with sway bracing, shelving brackets, shelving surfaces, and accessories as specified.
 - 1. Unit Width: 24 inches, center to center of posts.
 - 2. Shelf Capacity: Uniform distributed load of 50 psf, minimum.
 - 3. Shelf Deflection: 1/4 inch in 36 inches, maximum, under specified uniform load.
 - 4. Adjustability of Shelving: At intervals of 6 inches on center, minimum.
 - 5. Shelf Depth: 14-1/2 inches, minimum.
 - 6. Shelves per Unit: As indicated on drawings.
 - 7. Finish: Baked enamel, medium gloss.
 - 8. Color: As selected by Architect from manufacturer's standard range.
 - 9. Provide double-face units only.
 - 10. Number of Units: As indicated on drawings.
- B. Posts and Beams: Formed sheet members; perforations exposed on face of members are not acceptable.
 - 1. Metal Thickness: 16 gauge, 0.0598 inch.
 - 2. Post Shape: Tee intermediate posts, angle end posts forming corners.
 - 3. Post Face Width: 2 inches, maximum.
 - 4. Connecting Hardware: Manufacturer's standard.
- C. Bracing: Formed sheet members.
 - 1. Back Sway Bracing: Either strap or panel; at back of each unit.
 - 2. Side Sway Bracing: Either strap or panel; at each side of each unit.
 - 3. Strap Sway Bracing: One strap installed diagonally, 16 gauge, 0.0598 inch; welded, riveted, or bolted to uprights.
 - 4. Panel Sway Bracing: Formed sheet metal panels, 20 gauge, 0.0359 inch; welded, riveted, or bolted to uprights.
- D. Shelves: Formed stainless steel wire; brushed or satin finish; cut ends concealed or smoothed for safety.
 - 1. Wire Diameter: 1/8 inch, minimum.
 - 2. Maximum Opening Dimension: 1/4 inch, maximum.
 - 3. Shelf Edge Profile: Extending 3/4 inch high, maximum, below top surface of shelf.
 - 4. Shelf Connection to Posts: Manufacturer's standard.

2.04 CASE TYPE SHELVING, CABINETS, AND DESKS

- A. Case Type Shelving: Steel, closed sides and backs, with shelving brackets, shelving surfaces, and accessories as specified.
 - 1. Unit Width: 24 inches, overall.
 - 2. Shelf Capacity: Uniform distributed load of 50 psf, minimum.
 - 3. Finish: Baked enamel, medium gloss.
- B. Case Construction: Formed sheet metal comprising vertical support members and enclosure panels.
 - 1. Shelf Support Members: 16 gauge, 0.0598 inch, minimum; manufacturer's standard profile.

2. Face Width of Exposed Vertical Supports: 2 inches, maximum.
3. Panels: 24 gauge, 0.0239 inch, minimum.
4. Connecting Hardware: Manufacturer's standard.

2.05 CANTILEVERED SHELVING

- A. Cantilevered Shelving: Freestanding formed steel post frame with slots for cantilevered shelving brackets, sufficiently rigid not to require sway bracing, shelving brackets, shelving surfaces, and accessories as specified.
 1. Unit Width: 24 inches, center to center of posts.
 2. Shelf Capacity: Uniform distributed load of 50 psf, minimum.
 3. Adjustability of Shelving: At intervals of 1 inches on center, minimum.
 4. Finish: Baked enamel, medium gloss.
- B. Frame: Formed steel members comprising posts, horizontal spreaders at top and bottom, and base brackets resisting overturning; frame configuration providing full face height and width available for adjustable shelves.
 1. Sheet Metal Thickness: 16 gauge, 0.0598 inch, minimum.
 2. Base Brackets Height from Floor: 9 inches, maximum.
 3. Connecting Hardware: Manufacturer's standard.
 4. Provide manufacturer's standard adjustable leveling devices.
- C. Shelf Brackets: Combination shelf support and bookend, formed steel; full depth of shelves and minimum 6 inches height above shelf surface; rounded outer edges and corners for safety.
 1. Thickness: 16 gauge, 0.0598 inch, minimum.
 2. Connection to Posts: Two hooks at top, safety lug at bottom.
- D. Shelves: Formed steel, finished on all surfaces.
 1. Thickness: 18 gauge, 0.0478 inch, minimum.
 2. Bottom Shelf Edge Profile: 1 inch with integral kickplate.
 3. Upper Shelves Edge Profile: Extending 3/4 inch, maximum, below top surface of shelf.
 4. Shelf Connections: Tab interlock with brackets ; positive bolt connection between shelf and bracket.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate is level and that clearances are as specified.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.
- C. Out-Of-Square Tolerance - Four Post Shelving: Maximum of 1/8 inch difference in distance between bottom shelf and canopy top, measured along any post in any direction.

3.04 CLEANING

- A. Clean shelving and surrounding area after installation.

END OF SECTION

**SECTION 11 30 13
RESIDENTIAL APPLIANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Kitchen appliances.
- B. Laundry appliances.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.
- D. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

1.04 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

PART 2 PRODUCTS

2.01 COMPONENTS

- A. Dimensions in the Fixture and Appliance Design Criteria Matrix on the Drawings are based upon information provided by the manufacturer at time of selection by the Owner.
- B. Layout of the Kitchens and Bathrooms is based on these dimensions. Substitutions may impact the design and thus compliance with accessibility requirements and other technical requirements.
- C. Substitutions are only allowed after prior written approval from the Owner, Architect, or Owner and Architect.
- D. Performance:
 - 1. All Equipment Eligible for Energy Star Rating: Energy Star Rated.
 - a. ENERGY STAR labeled dishwasher(s) that use 6.0 gallons or less per cycle.
 - 2. Water Efficient Clothes Washer: Install clothes washers with modified energy factor (MEF) >_ 2.0 and water factor (WF) < 5.5. Clothes washers must be installed in each unit, or provided in a shared facility to adequately meet the demand of the entire building.
 - 3. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by DOE.
 - 4. Garbage disposers must meet required accessibility clearances indicated.

- E. Range and Dishwasher Controls: Solid state electronic.

2.02 KITCHEN APPLIANCES

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Refer to Equipment Schedule on drawings.

2.03 LAUNDRY APPLIANCES

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Refer to Equipment Schedule on drawings.

2.04 EXTERIOR APPLIANCES

- A. Exterior Barbecue Equipment:
 - 1. Fuel: Natural Gas.
 - 2. Accessories: Built in with counter anchor kit.
 - 3. Exterior Finish: Stainless steel.
 - 4. Basis of Design Manufacturer:
 - a. BroilMaster by Empire Comfort Systems, Inc.; Product _____:
www.broilermaster.com.
 - b. Weber; www.weber.com
 - c. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor built-in equipment in place.

3.03 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.04 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION

**SECTION 11 85 10
PET GROOMING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pet tub, dryers and grooming station

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Provide materials list of items proposed.
 - 2. Manufacturer's Specifications and other Data needed to show compliance with specified requirements.
 - 3. Manufacturer's recommended installation procedures.
 - 4. Manufacturer's operating/maintenance instructions.

1.03 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 COMPONENTS

- A. Grooming Table with Arm:
 - 1. Product: See Interior Drawings Equipment and Finish Schedule.
- B. Wall mount Pet Dryer:
 - 1. Product: See Interior Drawings Equipment and Finish Schedule.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

**SECTION 12 24 13
ROLLER WINDOW SHADES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manually operated sunscreen roller shades.
- B. Manually operated room-darkening 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 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
 - 3. Storage and handling requirements and recommendations.
 - 4. Mounting details and installation methods.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
 - 1. Prepare shop drawings on Autocad format using base sheets provided electronically by the Architect.
- D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- E. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.
- G. Environmental Certification:
 - 1. Submit written certification from manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification.
 - 2. Initial submittals, which do not include the Environmental Certification, below will be rejected.
 - 3. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.
- H. Third Party Evaluation:

1. Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety.
 2. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting.
 3. Identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens.
 4. Material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.
- I. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than twenty years of experience.
- B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
- C. Fire-Test-Response Characteristics: Passes NFPA 701, small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi.

1.05 MOCK-UP

- A. Provide a mock-up of one roller shade assembly for evaluation of mounting, appearance and accessories.
 1. Locate mock-up in window designated by Architect.
 2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.08 WARRANTY

- A. Roller Shade Hardware, Chain and Shadecloth (except EcoVeilä): Manufacturer's standard non-depreciating twenty-five year limited warranty.
 1. EcoVeil standard non-depreciating 10-year limited warranty.
- B. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: MechoShade Systems, Inc; www.mechoshade.com.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLICATIONS/SCOPE

- A. Roller Shade Schedule:
 - 1. Manual operating, chain drive, sunscreen roller shades in all exterior windows of rooms and spaces shown on the Drawings.
 - 2. Manual operating interior, chain drive room darkening roller shades with blackout fabric in all exterior windows of rooms and spaces shown on Drawings, and related mounting systems and accessories.

2.03 SHADE CLOTH

- A. Visually Transparent Single-Fabric Shadecloth:
 - 1. ThermoVeil group, single thickness non-raveling 0.030-inch thick vinyl fabric, woven from 0.018-inch diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.
 - a. Dense Vertical Weave: "1000 series", 2-3 percent open, lineally vertical weave pattern.
 - b. Extra - Dense Linear Weave "0900 series", 0-1 percent visually translucent linear weave pattern.
 - c. Open Basket Weave: "2100 series", 10 percent open, 2 by 2 open basket-weave pattern.
 - d. Dense Basket Weave: "1300 series", 5 percent open, 2 by 2 dense basket-weave pattern.
 - e. Dense Basket Weave: "1500 series", 3 percent open, 2 by 2 dense basket-weave pattern.
 - f. Dense "3000 Satin Texture", "3200 Diamond Pastel", and "3300 Diamond Earthtone series" visually translucent, twill-weave pattern all at 2 percent open.
 - g. Color: Selected from manufacturer's standard colors.
 - 2. EuroVeil "5300" or EuroTwill "6000" Series: 0.010 diameter non-raveling vinyl/polyester yarn, fabric thickness 0.025 inches .
 - a. Dense Basket Weave "5300 series, 5 percent open.
 - b. Extra Dense Twill Weave "6000" series, 2-3 percent open.
 - c. Color: Selected from manufacturer's standard colors.
- B. Vinyl Room Darkening Shadecloth (Single-Fabric):
 - 1. "0700 series", blackout material, washable and colorfast laminated and embossed vinyl coated fabric, 0.012 inches thick blackout material and weighing 0.81 lbs. per square yard, with a minimum of 62 threads per square inch in colors selected from manufacturer's available range.
 - 2. Color: Selected from manufacturer's standard colors.
- C. Room darkening (PVC Free) Shadecloth with opaque acrylic backing:

1. "Equinox 0100 series", .008 inches thick blackout material and weighing .94 lbs. per square yard, comprising of 53% fiberglass, 45% acrylic, 2% poly finish.
 2. Color: Selected from manufacturer's standard colors.
- D. Environmentally Certified Shadecloth:
1. EcoVeil group, 1350 Series, fabricated from TPO for both core yarn and jacket, single thickness, non-raveling 0.030 inch thick fabric.
 2. Weave: 5 percent open 2 x 2 basket weave.
 3. Color: Selected from manufacturer's standard colors.

2.04 SHADE BAND

- A. Shade Bands: Includes fabric, hem weight, hem-pocket, shade roller tube, and attachment of shade band to roller tube. Sewn hems and open hem pockets are not acceptable.
1. Hem Pockets and Hem Weights:
 - a. Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights.
 - b. Weights to be of appropriate size and weight for shade band.
 - c. Weight to be continuous inside a sealed hem pocket.
 - d. Hem pocket construction and hem weights to be similar, for all shades within one room.
 2. Shade band and Shade Roller Attachment:
 - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
 - 1) Tubes less than 1.55 inch in diameter are not acceptable.
 - b. Provide for positive mechanical engagement with drive / brake mechanism.
 - c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
 - d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.05 SHADE FABRICATION

- A. Units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
- B. Shadecloth to hang flat without buckling or distortion.
- C. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling.
- D. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design.
- E. Fabricate hem as follows:
 1. Concealed hemtube.
- F. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands.
 1. Width-to-height (W:H) ratios shall not exceed manufacturer's standards.
 2. Battens to be roll-formed stainless steel or tempered steel.

- G. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in a integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.
1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.
 2. Batten pockets shall be self-colored fabric front and back RF welded into the shadecloth. A self-color opaque liner shall be provided front and back to eliminate any see through of the batten pocket that shall not exceed 1-1/2 inches high and be totally opaque. A see-through moiré effect, which occurs with multiple layers of transparent fabrics, shall not be acceptable.

2.06 COMPONENTS

- A. Access and Material Requirements:
1. Allow for removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
 2. Allows for removal and re-mounting of shade bands without having to remove shade tube, drive or operating support brackets.
 3. Use only Delrin engineered plastics by DuPont for plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.
- B. Manual Operated Chain Drive Hardware and Brackets:
1. Universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets.
 2. Hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
 3. Shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
 4. Shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
 5. Shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
 6. Positive mechanical engagement of drive mechanism to shade roller tube.
 - a. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
 7. Shade hardware constructed of minimum 1/8-inch thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
 8. Drive Bracket / Brake Assembly:
 - a. Model M5 to be fully integrated with accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.

- b. Model M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch steel pin.
 - c. Brake shall be an over-running clutch design which disengages to 90 percent during the raising and lowering of a shade.
 - d. Pull Force: Withstand 50 lbs.in stopped position.
 - e. Braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. Oil impregnated hub design to include an articulated brake assembly, for a smooth, non-jerky operation in raising and lowering shades.
 - f. Assembly to be permanently lubricated.
 - 1) Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
 - g. M5 assembly shall be fully mounted on the steel support bracket, and fully independent of shade tube assembly, which may be removed and reinstalled without effecting roller shade limit adjustments.
- C. Drive Chain:
- 1. #10 qualified stainless steel chain rated to 90 lb. minimum breaking strength.
 - 2. Nickel plate chain shall not be accepted.

2.07 ACCESSORIES

- A. Roller Shade Pocket for recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings.
- 1. Provide either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.
 - a. Provide "Vented Pocket" such that there will be a minimum of four 1 inch (25.4 mm) diameter holes per foot allowing the solar gain to flow above the ceiling line.
- B. Fascia:
- 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
 - 2. Fascia shall be able to be installed across two or more shade bands in one piece.
 - 3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
 - 4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
 - 5. Notching of Fascia for manual chain shall not be acceptable.
- C. Room Darkening Side and / or Sill Channels:
- 1. Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fastening is not acceptable. Channels shall accept one-piece exposed blackout hembar with vinyl seal to assure side light control and sill light control.
 - a. Side channels, 1-15/16 inches wide by 1-3/16 inches deep and two-band center channels, 2-5/8 inches wide by 1-3/16 inches deep.
 - b. For shadebands over 8 feet, provide ElectroShade side channels.
 - 2. Color: Selected from manufacturer's standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer.

3.03 INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow proper clearances for window operation hardware.
- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- D. Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

**SECTION 12 35 30
RESIDENTIAL CASEWORK (MANUFACTURED)**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Kitchen cabinets.
- B. Countertop substrate

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.
- B. Coordinate the Work with plumbing and electrical rough-in, and other finish work.
- C. Coordinate with other trades for installation of concealed in-wall backing for support of cabinets.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, configurations, construction details, and joint details.
- C. Certificate: Submit Kitchen Cabinet Manufacturers Association (KCMA) certificate showing manufacturer has met the requirements of KCMA's Environmental Stewardship Program (ESP).
- D. Product Data: Provide data for each product used, including:
- E. Shop Drawings: Indicate casework locations, elevations, clearances required, rough-in and anchor placement dimensions and tolerances.
 - 1. Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
- F. Manufacturer's Qualification Statement.
- G. Verification Samples: Submit actual samples of architectural cabinet construction, minimum 6 x 12 inches, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- H. Samples: Submit two actual sample items of proposed pulls, hinges, and knobs, demonstrating hardware design, quality, and finish.

1.05 QUALITY ASSURANCE

- A. Products: Cabinets complying with requirements of KCMA's Environmental Stewardship Program (ESP).
- B. Manufacturer: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 MOCK-UP

- A. Section 01 43 39 - Free Standing Building Mock-Up.
- B. Provide full size mock-up of casework base unit, upper cabinet, and counter top.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

- A. Do not deliver or install casework until building is enclosed, and heating and ventilating system is operating.
- B. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
 - 1. Maintain 50 degrees F temperature in areas that casework is installed.
 - 2. Maintain Relative Humidity between 25% & 55% in areas that work is installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Residential Casework:
 - 1. Lanz Cabinets: www.lanzcabinets.com.
 - 2. Tacoma Fixture Company; Product Valley Line Cabinets : www.tacomafixture.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CABINETS

2.03 MATERIALS - GENERAL

- A. Provide sustainably harvested lumber, certified or labeled as specified in Section 01 60 00.
- B. Provide lumber harvested within a 500 mile radius of the project site.
- C. Recycled content, FSC certified, or reclaimed AND composite materials must contain no added urea-formaldehyde resins.
- D. FSC Certified Tropical Wood. Meet the following two requirements, as applicable:
 - 1. Provide wood product suppliers with a notice containing following elements:
 - a. Statement that the builder's preference is to purchase products containing tropical wood only if it is FSC-certified;
 - b. Request for the country of manufacture of each product supplied; and
 - c. Request for a list of FSC-certified tropical wood products the vendor can supply.
 - 2. If tropical wood is intentionally used (i.e., specified in purchasing documents), use only FSC-certified tropical wood products. Reused or reclaimed materials are exempt.
 - 3. Species of wood is considered tropical for the purposes of this prerequisite if it is grown in a country that lies between the Tropics of Cancer and Capricorn.

2.04 CABINET CONSTRUCTION

- A. Wood Veneer Faced Cabinet:
 - 1. Exposed Surfaces: Ash, plain sliced, random-matched.
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Cabinets:
 - 1. Cabinet Style: Frameless.
 - 2. Cabinet Construction: Softwood lumber framing and formaldehyde free particle board.
 - a. Board Thickness: 5/8 inches.
 - 3. Shelf Construction: Formaldehyde free particle board.
 - a. Board Thickness: 5/8 inches.
 - 4. Casework Construction Technique: Dowel joints.
 - 5. Finish - Exposed Exterior Surfaces: Wood.
 - a. Exposed surfaces at removable cabinets faces: Match cabinet face.
 - 6. Finish - Exposed Interior Surfaces: Thermoset Decorative Overlay.
 - 7. Finish - Concealed Surfaces: Manufacturer's option.
 - 8. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
 - 9. Cabinet Design Series: As indicated on drawings.
 - 10. Adjustable Shelf Loading: 50 lbs. per sq. ft.

2.05 COMPONENTS

- A. Cabinet Construction: Softwood lumber framing and particle board.
- B. Countertops: As specified in Section 12 36 00.
- C. Door and Drawer Fronts: Solid wood.
- D. Bolts, Nuts, Washers and Screws: Of size and type to suit application.
- E. Concealed Joint Fasteners: Threaded steel.

2.06 PANEL MATERIALS

- A. Veneer Faced Plywood Finish: Core of particleboard; type of glue recommended for specific application; thickness as required.
- B. Thermoset Decorative Overlay: MDL Melamine Overlay as manufactured by one of the following, colors as selected from manufacturer's standard:
 - 1. Manufacturer:
 - a. Roseburg Melamine Products (RMP)
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 COUNTERTOP SUBSTRATE MATERIALS

- A. Plywood: Exterior softwood plywood complying with PS 1, Grade C-C Plugged, touch sanded.
 - 1. Thickness: 3/4 inch.

2.08 HARDWARE

- A. Hardware: Manufacturer's standard.

- B. Cabinet Shelf Supports: Metal pins set in drilled system holes.
- C. Knobs, Drawer and Door Pulls: See Section 09 06 02.
- D. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: 75 lbs.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Finish: Epoxy coated.
 - 6. Features: Provide self closing/stay closed type.
 - 7. Product Types:
 - a. Pencil Drawers: Accuride 2006, Steel ball bearings, 3/4 extension, load capacity up to 45 lbs. per pair.
 - b. Light to Medium Duty Drawers: Accuride 3832A, Steel ball bearings, full extension, load capacity up to 100 lbs. per pair; for drawers that are deeper than they are wide.
 - c. Light to Medium Duty Drawers: Accuride 7432, Steel ball bearings, full extension, load capacity up to 100 lbs. per pair; for drawers 24 inches wide or less.
 - d. Medium to Heavy Duty Drawers: Accuride 4034, Steel ball bearings, full extension with 1 inch overtravel, progressive movement, load capacity 150 lbs. per pair; for drawers 24 inches wide or less.
 - e. Heavy Duty or Lateral File Drawers: Accuride 3640, Steel ball bearings, full extension with 1 inch overtravel, progressive movement, load capacity up to 200 lbs. per pair; for drawers 42 inches wide or less.
 - 8. Products:
 - a. Accuride International, Inc; ____: www accuride.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Hinges: European style concealed self-closing type, steel with polished finish.
 - 1. 110 degree opening
 - 2. Minimum three hinges for doors over 48 inches high.
 - 3. Products:
 - a. Basis of Design: Grass America Inc; Product 3000 series: www.grassusa.com.
 - b. Hardware Resources: www.hardwareresources.com.
 - c. Julius Blum, Inc: www.blum.com.
 - d. Hafele.
 - e. Hettich.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Kitchen Accessories
 - 1. Lazy Susan: Hafele
 - a. One-quarter turn system (half moon), #541; 1 per unit, coordinate size with opening.
 - b. Three-quarter round #541; 1 per unit, coordinate size with opening.
 - 2. Undersink Storage Unit: Hafele #545.42.705, (1) per unit.
 - 3. Waste Bin: Hafele #502.70.767 1 per unit.
 - 4. False front tip out try system: Amerock, Rev-A-Shelf #6581.
 - a. Size: 11 inches wide.

2.09 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fabricate corners and joints without gaps.
- C. Fabricate each unit to be rigid and not dependent on adjacent units for rigidity.
- D. Upper Cabinet: Exposed underside to match cabinet face.
- E. Exposed Cabinet Sides to match cabinet face, including exposed partially exposed sides at appliances.
- F. Form smooth edges. Form material for countertops, shelves, and drain boards from continuous sheets.
- G. Base Cabinets Depths: Coordinate with overall countertop depth, see Section 12 36 00 for fabrication.
- H. Provide cutouts for plumbing fixtures, appliances, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.
 - 1. Verify appliance clearances based on approved submittals.
- I. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.10 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.
- C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- D. Finish work as follows:
 - 1. Transparent:
 - a. UV Curable, Water-based.
 - b. Stain: As selected by Architect.
 - c. Sheen: Semigloss.
 - 2. Opaque:
 - a. Color: As selected by Architect.
 - b. Sheen: Semigloss.

2.11 FINISHES

- A. See Section 09 0602.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of support framing.

3.02 INSTALLATION

- A. Install casework, components and accessories in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Carefully scribe casework abutting other components, with maximum gaps of ____ inch.
- E. Close ends of units, back splashes, shelves and bases.

3.03 ADJUSTING

- A. Adjust doors, drawers, hardware, and other moving or operating parts to function smoothly.

3.04 CLEANING

- A. Clean casework, countertops, shelves, and hardware.

3.05 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

**SECTION 12 36 00
COUNTERTOPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Countertops for residential manufactured casework.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- B. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.
- C. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- D. PS 1 - Structural Plywood 2019.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials, installation and seaming locations; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. Manufacturers:
 - 1) See Section 09 06 02 Materials and Finishes Schedule.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Finish: See Section 09 06 02 Materials and Finishes Schedule.
 - d. Surface Color and Pattern: To be selected from manufacturer's full line.
 2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
 3. Back and End Splashes: Same material, same construction.
 4. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.
- B. Wood Countertops: One-piece, laminated under pressure.
1. Hardwood plywood for semi-exposed surfaces: Apple-Ply.
 - a. See Section 09 06 02 Materials and Finishes Schedule.
 2. Thickness: 3/4 inch, minimum.
 3. Edges: Built-up, See drawings.
 4. Finish: See Section 09 06 02 Materials and Finishes Schedule.
- C. Engineered Quartz Countertops:
1. Composition: 93 percent crushed quartz aggregate combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.
 2. Manufacturer:
 - a. See Section 09 06 02 Materials and Finishes Schedule.
 3. Dimensions:
 - a. Size: As indicated on drawings.
 4. Performance:
 - a. Flexural Strength: 7,420 psi, ASTM C880.
 - b. Compressive Strength: ASTM C-170
 - 1) Dry: 10,430 psi average.
 - 2) Wet: 11,265 psi average.
 - c. Izod Impact Strength: 0.361ft. lbs./inch of notch average; ASTM D256.
 - d. Bond Strength: 205 psi; ASTM C482 modified.
 - e. Modulus of Rupture: 2,110 average, ASTM C99.
 - f. Mohs Hardness: 6.5-7.5; scratch test.
 - g. Absorption: 0.022%; ASTM C97.
 - h. Stain and Acid Resistance: Not affected; ASTM D2299.
 - i. Surface Burning Characteristics: Flame spread = 10, smoke density = 195; ASTM E84.
 - j. Thermal Shock Resistance: Passes 5 cycles, 75°F-295°F; ASTM C484.
 - k. Coefficient of Thermal Expansion: 1.36x10 inch per °F.; ASTM C531.

- l. Weathering Resistance: Not affected after seven days in 1% sulfuric acid; ASTM C217.
- m. Freeze-Thaw Resistance: No visible damage or discoloration after 25 cycles (-45°C to 23°C); S.L.P. with ASTM C62 as guide.
- n. Wear Resistance: 36.12 gram average; ASTM C501, tested with 1 kg. load, 1000 cycles at 70 r.p.m.
- o. Static Coefficient of Friction:
 - 1) Polished Finish: 0.68 average by ASTM D2047, James Machine; 0.87 average (dry) and 0.54 average (wet) by ASTM C1028, Dynamometer Pull Method.
- 5. Finish:
 - a. Polished Surface, gloss greater than or equal to 35% at 50°.
- 6. Exposed Edges and Corners:
 - a. Countertops:
 - 1) Edges: Mitered per drawings.
 - 2) Exposed Ends: Waterfall per drawings.
 - b. Backsplash:
 - 1) Edges: Eased.

2.02 MATERIALS

- A. Wood-Based Components:
 - 1. Wood fabricated from old growth timber is not permitted.
- B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- D. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 ACCESSORIES

- A. Grommets:
 - 1. Type 1 :1 inch diameter plastic liner and cap. Color: As selected from manufacturers standard colors.
 - a. Manufacturer: Doug Mockett & Company, Inc; www.mockett.com
 - 1) Product: OG Series.
- B. Power Outlet: Pop-up power grommet, 2 power/1dual USB charger.
 - 1. Manufacturer: Doug Mockett & Company, Inc; www.mockett.com.
 - a. Product: PCS82B/U1.
 - b. Color: Bla

2.04 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.

3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch.
- D. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 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 12 48 13
ENTRANCE FLOOR MATS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet mat.
- B. Vinyl link mat with custom design inlay.
- C. Recessed mat frames.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.
- C. Shop Drawings: Indicate dimensions and details for recessed frame.
- D. Maintenance Data: Include cleaning instructions, and stain removal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Entrance Floor Mats:
 - 1. _____.

2.02 MATS

- A. Link Mat: Extruded vinyl links fastened with 11 gauge galvanized spring steel wire; overall size ____ inch wide x ____ inch long, 1/2 inch thick; square nosing; black color with pattern as selected.

PART 3 EXECUTION

3.01 PREPARATION

- A. Vacuum clean floor recess.

3.02 INSTALLATION

- A. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

3.03 TOLERANCES

END OF SECTION

**SECTION 12 93 13
BICYCLE RACKS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outdoor bicycle racks.
- B. Indoor bicycle racks.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
- C. Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Handle racks and accessories with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 BICYCLE RACKS AND ACCESSORIES

- A. Outdoor Bicycle Racks: Device allows user provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
 - 1. Manufacturer: Refer to Landscape drawings and schedules.
 - 2. Style: Outdoor, recessed mounted, single level.
 - 3. Capacity: 2 bicycles.
 - 4. Mounting, Ground: In-ground anchor.
 - 5. Finish: Powder coat, maintenance-free and weather-resistant.
 - 6. Color: As selected by Architect from manufacturer's standard range.
 - 7. Accessories: In-ground grout cover.

- B. Indoor Bicycle Racks: Device designed for indoor storage of bicycles; allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
 - 1. Manufacturer: Dero: www.dero.com.
 - a. Product: Bike Hook Solo.
 - 2. Style: Indoor, wall mounted, single level, vertical, single-sided storage rack with fixed arms and locking cable.
 - 3. Materials:
 - a. Bike Hook Solo: 3/16" steel plate
 - b. Security Cable: 3/16" vinyl coated cable.
 - c. Wall Guard: 14g aluminum plate.
 - 4. Color: As selected by Architect from manufacturer's standard range.
 - 5. Space Allocation:
 - a. Ceiling height: 78" is the minimum ceiling height. The top of the rack should have a minimum height of 68"
 - b. Distance Between Racks: 28" is the minimum distance between level racks. 17" is the minimum distance between racks with staggered heights.
- C. Accessible Floor Mounted Interior Bicycle Racks: Device designed for indoor storage of bicycles; allows user provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
 - 1. Manufacturer: Dero: www.dero.com.
 - a. Product: Hoop Rack.
 - 2. Style: Indoor, floor mounted, single level, horizontal loop rack.
 - 3. Capacity: 2bicycles.
 - 4. Finish: Powder coat, maintenance-free and weather-resistant.
 - 5. Color: As selected by Architect from manufacturer's standard range.
- D. Materials:
 - 1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40.
 - 2. Tube: Carbon steel, ASTM A500/A500M.
 - 3. Bar, Round and Flat, Carbon Steel: ASTM A36/A36M.

2.02 BICYCLE REPAIR

- A. Bicycle Pump
 - 1. Basis of Design: Dero; Product: Air Kit 4; www.dero.com.
- B. Bicycle Repair Station:
 - 1. Basis of Design: Dero; Product: Fixit Plus Repair Station: www.dero.com.
 - 2. Capacity: 1bicycles.
 - 3. Mounting: Surface flange, per manufacturer's instructions.
 - 4. Finish: Powder coat, maintenance-free and weather-resistant.
 - 5. Color: Selected from manufactures standard colors.
 - 6. Location: Where shown on Drawing.

2.03 FABRICATION

- A. Shop assemble site furnishings for delivery to site in units easily handled and to permit shipment without disassembly.

- B. Sand work smooth and set exposed nails and screws. Apply wood filler in exposed nail and screw indentations that matches wood color.
- C. Shop finish wood components with manufacturer's standard sealer/preservative, unless otherwise indicated. Shop finish steel components with manufacturer's standard bronzetone enamel coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive bicycle racks and accessories..
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.02 PREPARATION

- A. Ensure surfaces to receive bicycle racks and accessories are clean, flat, and level.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install bicycle racks and accessories level, plumb, square, and correctly located as indicated on drawings.
- C. Vertical Wall Installation:
 - 1. Installation Methods: Concrete wall mounted use 3/8" drop-in anchors with tamperproof screws. Wood and drywall mounted use 1/4" lag screws into solid backing.
- D. Coordinate installation of accessories with plumbing and electrical work by other trades.
- E. In-Ground Anchor Installation:
 - 1. Prepare holes in size according to manufacturer's instructions.
 - 2. Place anchoring bolts through the holes in the pipe.
 - 3. Lower rack into holes, ensuring the bottom of lower bends are at least 1-1/2 inch from the ground.
 - 4. Pour concrete and level rack.
 - 5. Support until dry.

3.04 CLEANING

- A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

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 13 11 00
SWIMMING POOLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Delegated Designed Shotcrete concrete swimming pool and pool accessories.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on accessories .
- C. Shop Drawings: Indicate pool layout, configuration, lighting locations, equipment locations, dimensions, details of assembly, anchors, and utility rough-in locations.
 - 1. Indicate pool tank structural supports: Include layout, details, and seal and signature of design professional responsible for design.
- D. Manufacturer's Installation Instructions: Indicate special installation procedures.
- E. Designer's Qualification Statement.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Operation Data: Provide operating instructions .
- I. Maintenance Data: Provide maintenance instructions, maintenance schedules .

1.03 QUALITY ASSURANCE

- A. Designer Qualifications: Design pool tank structural components under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.04 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for _____.

PART 2 PRODUCTS

2.01 SHOTCRETE POOL MATERIALS

- A. Spray-Applied Shotcrete Concrete and Reinforcement:
- B. Coping: Precast concrete coping, color as selected by Architect from manufacturer standard colors.
- C. Gutter: Manufacturer standard.
- D. Deck Surfacing: Trowelled concrete specified in Section 03 30 00, broom finish and sealer.
- E. Pool Tank Surfacing: Ceramic tile as specified in Section 09 30 00.

2.02 PIPE AND FITTINGS

- A. Exposed Piping: Copper Type L
- B. Concealed Piping: PVC Type schedule 40, 200 psi.
- C. Valves and Fittings:
- D. Deck Drains: Cicolac safety type

2.03 EQUIPMENT

- A. Bidder designed to provide a complete saline system and meet local governmental authorities.

2.04 POOL DECK EQUIPMENT

- A. Hand rail at built-in steps, stainless steel, 1 required.
- B. Pool safety equipment required by Oregon Health Department.
- C. Maintenance equipment and vacuum system.
- D. Start-up chemicals and DPD test kit.
- E. Isocyanuric test kit.
- F. Thermometer
- G. Ladder: 3 tread with cross brace.
- H. Pool rule sign.
- I. Nozzles: 8 venturi, adjustable.
- J. Air siphon: 4 units.

2.05 POOL SPECIALTY FITTINGS & FIXTURES

- A. Underwater light: 4 units, 500 watt, Purex.
- B. Skimmer: 2 required, automatic adjusting, Baker Hydro.
- C. Main drain: 2 required, grate type.
- D. Return: 4 required, directional adjustable
- E. Hydrostatic valve: 1 unit.

2.06 SWIMMING POOL LIFT

- A. Manufacturer:
 - 1. Refer to drawings, Pool Details and Notes.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 SPA DECK EQUIPMENT

- A. Hand rail at built-in steps, stainless steel, 1 required.
- B. Thermometer
- C. Spa rule sign

2.08 SPA SPECIALTY FITTINGS & FIXTURES

- A. Underwater light: 1 unit, 300 watt, Purex
- B. Skimmer: 1 required, automatic adjusting, 9" weir, Baker Hydro.
- C. Main drain and suction fittings: 2 required, 8" SwimQuip.
- D. Return: 1 required, directional adjustable eyeball, SwimQuip 8434.
- E. Nozzles: 8 required, directional adjustable.

2.09 ACCESSORIES

- A. Ladder: Meet ADA and Building code requirements.
- B. Sealant: Type recommended by manufacturer for pools.
- C. Anchors: Non-corrosive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify excavation surfaces are clean, smooth, and without voids or irregularities.
- B. Verify grounding of electrical and metallic components before shotcreting.

3.02 INSTALLATION - SHOTCRETE CONCRETE POOL

- A. Install mesh reinforcement and gun apply concrete to prepared excavation.
- B. Develop concrete average thickness to 8 inch and minimum thickness of 6 inch. Trowel smooth.
- C. Coordinate installation of mechanical and electrical components; connect to utilities.
- D. Fill pool, activate filtration and circulation equipment, and chemically stabilize.

3.03 INSTALLATION - POOL AND DECK FINISH

- A. Install pool tank finish in accordance with manufacturer's instructions and indicated on drawings.
- B. Install deck finish as indicated on drawings and finish schedule.

3.04 TILE AND COPING

- A. Provide handholds around top of pool perimeter as required by Code; install perimeter overflow channels as required by Code. For installation of tile and concrete coping, see Section 09310; comply with Code requirements regarding markings and safety warnings.

3.05 PLASTERING

- A. General:
 - 1. Do not begin plastering until at least 20 days after completion of gunite/shotcrete.
 - 2. Do not plaster during rainy or windy weather unless specifically otherwise approved by Architect.
- B. Application:
 - 1. Uniformly trowel on coat of specified plaster into parging coat of gunite/shotcrete, achieving a smooth dense, and impervious surface completely without stains.
 - 2. Make coat not less than 1/4 inch and not more than 3/8 inch thick.
 - 3. Uniformly meet edge of adjoining ceramic tile or concrete coping as shown.
- C. Upon completion of plastering and application of finish coat, immediately commence filling operations by uniform and steady slow stream of potable water introduced through a hose equipped with a dampening device to prevent erosion.
- D. Do not interrupt flow of water until pool is filled above bottom edge of ceramic tile

3.06 HEATER

- A. Install heaters per National Electrical Code and Uniform Mechanical Code.
- B. Heater thermostat switches to be inaccessible to pool users.
- C. INITIAL WATER BALANCE
- D. Upon completion of installation, chlorinate, acidulate and properly balance ph content of water.

3.07 INSTALLATION - ACCESSORIES

- A. Install pool accessories and fittings in accordance with component manufacturer's instructions.

END OF SECTION

SECTION 14 21 00
ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Complete electric traction elevator systems.
 - 1. Passenger type.

1.02 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- C. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- D. AISC 360 - Specification for Structural Steel Buildings 2022.
- E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
- F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- G. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices 2019, with Errata (2021).
- H. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, and Dumbwaiters 2020.
- I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- K. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- N. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- O. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- P. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- Q. NEMA MG 1 - Motors and Generators 2021.
- R. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- S. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- U. PS 1 - Structural Plywood 2019.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other installers to provide necessary conduits for proper installation of wiring, including but not limited to, the following:
 - a. Elevator equipment devices remote from elevator machine room or hoistway.
 - b. Telephone service for machine room.
 - c. Elevator pit for lighting, sump pump, and ____.
 - d. Automatic transfer switch from controller cabinet.
 - e. Fire alarm panel from controller cabinet.
 - 2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
 - a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
 - b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation; include provisions for shunt trip power monitoring.
 - c. Overcurrent protection devices selected to achieve required selective coordination.
- B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
 - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
 - 2. Review use of elevator for construction purposes, hours of use, scheduling of use, cleanliness of car, employment of operator, and maintenance of system.
- C. Construction Use of Elevator: Not permitted.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on following items:
 - 1. Signal and operating fixtures, operating panels, and indicators.
 - 2. Car design, dimensions, layout, and components.
 - 3. Car and hoistway door and frame details.
 - 4. Electrical characteristics and connection requirements.
- C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
 - 1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
 - 2. Hoistway Components: Size and location of car machine beams, guide rails, buffers, ropes, and other components.
 - 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.

4. Clearances and over-travel of car and counterweight.
 5. Locations in hoistway and machine room of traveling cables and connections for car lighting and telephone.
 6. Location and sizes of hoistway and car doors and frames.
 7. Electrical characteristics and connection requirements.
 8. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Operation and Maintenance Data:
1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
 2. Operation and maintenance manual.
 3. Schematic drawings of equipment, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design - Electric Traction Elevators: Schindler Elevator Corp;; Model: 3300 MRL: .
- B. Other Acceptable Manufacturers - Electric Traction Elevators:
 1. Otis Elevator Company: www.otis.com/#sle.
 2. ThyssenKrupp Elevator: www.thyssenkruppelevator.com/#sle.
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ELECTRIC TRACTION ELEVATORS

- A. Electric Traction Passenger Elevator, No. EL-1 & EL-2:
 1. Electric Traction Elevator Equipment:
 - a. Gearless Traction Machine: Single wrapped traction driving sheave, with dual brake.
 2. Drive System:
 - a. Variable voltage alternating current (AC).

3. Operation Control Type:
 - a. Selective Collective Automatic Operation Control.
4. Service Control Type:
 - a. Standard service control only.
5. Interior Car Height: 93 inch.
6. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
7. Rated Net Capacity: 3000 pounds.
8. Rated Speed: 100 feet per minute.
9. Hoistway Size: As indicated on drawings.
10. Interior Car Platform Size: As indicated on drawings.
11. Elevator Pit Depth: 60 inch.
12. Overhead Clearance at Top Floor: 151 inch.
13. Travel Distance: As indicated on drawings.
14. Number of Stops: As indicated on drawings.
15. Number of Openings: 5 Front.
16. Traction Machine Location: Top of hoistway shaft.

2.03 COMPONENTS

- A. Elevator Equipment:
 1. Motors, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70 requirements, and see Section 26 05 83 for additional requirements.
 2. Guide Rails, Cables, Counterweights, Sheaves, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
 3. Buffers:
 - a. Spring type for elevators with speed less than or equal to 200 feet per minute.
 4. Lubrication Equipment:
 - a. Provide grease fittings for periodic lubrication of bearings.
 - b. Grease Cups: Automatic feed type.
 - c. Lubrication Points: Visible and easily accessible.
- B. Electrical Equipment:
 1. Motors: NEMA MG 1.
 2. Boxes, Conduit, Wiring, and Devices: Complying with NFPA 70, and see Sections 26 05 33.13 and 26 05 83 for additional requirements.
 3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
 4. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Provide additional components and wiring to suit machine room layout. See Section 26 05 83.

2.04 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards.

- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
 - 1. Comply with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1, ASCE 7 and other related requirements.
 - 2. Provide earthquake emergency operations in accordance with ASME A17.1 requirements.
 - 3. Provide seismic switch in accordance with ASME A17.1 and ASCE 7 requirements.
- E. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- F. Fabricate and install door and frame assemblies in accordance with NFPA 80 and complying with requirements of authorities having jurisdiction (AHJ).
- G. Perform electrical work in accordance with NFPA 70.
- H. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).
- I. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ). Refer to Section 21 13 00.

2.05 OPERATION CONTROLS

- A. Elevator Controls: Provide landing operating panels and landing indicator panels.
 - 1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
 - 2. Landing Indicator Panels: Illuminating.
 - 3. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.
- C. Door Operation Controls:
 - 1. Program door control to open doors automatically when car arrives at floor landing.
 - 2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
 - 3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.
- D. Lobby Monitoring Panel:
 - 1. Locate status indicator and control panel for each individual elevator and group of elevators as indicated on drawings.
 - 2. Etch face plate markings in panel, and fill with paint of contrasting color.
 - 3. Include direction indicator displaying landing "Up" and "Down" calls registered at each landing floor.
 - 4. Include position and motion display for direction of travel of each elevator; display appropriate graphic characters on non-glare screen; indicate position of cars at rest and in motion.
 - 5. Include "Firefighter's Service Switch" that manually recalls each elevator to main floor.
- E. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).

2.06 OPERATION CONTROL TYPE

- A. Selective Collective Automatic Operation Control: Applies to car in single elevator shaft.
 - 1. Refer to description provided in ASME A17.1.
 - 2. Automatic operation by means of one button in the car for each landing served and by "UP" and "DOWN" buttons at the landings.
 - 3. Stops are registered by momentary actuation of landing car buttons without consideration of the number of buttons actuated or the sequence buttons are actuated, but the stops are made in the order that landings are reached in each direction of travel.
 - 4. All "UP" landing calls are made when car is traveling in the up direction.
 - 5. All "DOWN" landing calls are made when car is traveling in the down direction.
 - 6. Uppermost and lowermost calls are answered as soon as they are reached without consideration of the car travel direction.

2.07 EMERGENCY POWER

- A. Set-up elevator operation to run with elevator emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.
- B. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.
- C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.
- D. Provide operational control circuitry for adapting the change from normal to emergency power.
- E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.08 MATERIALS

- A. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
- B. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- C. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.
- D. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.
- E. Plywood: PS 1, Structural I, Grade C-D or better, sanded.
- F. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.
- G. Carpet Flooring: See Section 09 68 16.
- H. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.09 CAR AND HOISTWAY ENTRANCES

- A. Elevator, No. EL-1 & EL-2:
 - 1. Car and Hoistway Entrances, Main Elevator Lobby:
 - a. Hoistway Fire Rating: As indicated on drawings.
 - b. Elevator Door Fire Rating: As indicated on drawings.

- c. Framed Opening Finish and Material: Brushed stainless steel.
 - d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
 - e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
 - f. Door Type: Double leaf.
 - g. Door Operation: Side opening, two speed.
 - h. Door Width: 42 inch.
 - i. Door Height: 84 inch.
 - j. Sills: Extruded aluminum.
2. Car and Hoistway Entrances, Upper Floor Elevator Lobbies:
 - a. Hoistway Fire Rating: As indicated on drawings.
 - b. Elevator Door Fire Rating: As indicated on drawings.
 - c. Framed Opening Finish and Material: Alkyd enamel on steel.
 - d. Car Door Material: Powder coat on steel, with rigid sandwich panel construction.
 - e. Hoistway Door Material: Powder coat on steel, with rigid sandwich panel construction.
 - f. Door Type: Double leaf.
 - g. Door Operation: Side opening, two speed.
 - h. Sills: Extruded aluminum.

2.10 CAR EQUIPMENT AND MATERIALS

- A. Elevator Car, No. EL-1 & EL-2:
 1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
 - a. Panel Material: Integral with front return; one per car.
 - b. Car Floor Position Indicator: Above door with illuminating position indicators.
 - c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
 - d. Provide following within service cabinet as part of car operating panel:
 - 1) Switch for each auxiliary operational control, keyed.
 - 2) Switches for fan, light, and inspection control.
 - 3) Emergency light.
 - 4) Telephone cabinet and hard-wired connection with telephone.
 - 5) Convenience outlet receptacle; 110 VAC, 15 amps.
 2. Ventilation: Single speed fan with grille in ceiling.
 3. Flooring: Resilient vinyl tile.
 4. Front Return Panel: Match material of car door.
 5. Door Wall: Plastic laminate on plywood.
 6. Side Walls: Plastic laminate on plywood.
 7. Rear Wall: Plastic laminate on plywood.
 8. Hand Rail: Aluminum, at each side wall. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
 - a. Round, Metal Tube: 1-1/2 inch diameter.
 - b. Aluminum Finish: Clear anodized.
 9. Ceiling:

- a. Canopy Ceiling: Stainless steel.
- b. Lighting: Compact fluorescent downlights.
10. Provide emergency access panel for egress from car at ceiling.
- B. Car Accessories:
 1. Certificate Frame: Stainless steel frame glazed with clear acrylic plastic, and attached with tamper-proof screws.
 2. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
 - a. Color: Tan.
 - b. Provide at least 4 inch clearance from bottom of pad to finished floor.
 - c. Pad Supports: Stainless steel studs, and mounted from ceiling frame.

2.11 FINISHES

- A. Powder Coat on Steel: Clean and degrease metal surface; apply one coat of primer; two coats of powder coat.
- B. Finish Paint for Metal Surfaces: Alkyd enamel, semi-gloss, color as selected, comply with VOC limitations of authorities having jurisdiction (AHJ).
- C. Clear Anodized Finish: Class I, AAMA 611 AA-M12C22A41 Clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mils, 0.0007 inch thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that hoistway, pit, and machine room are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components. See Section 01 50 00 - Temporary Facilities and Controls.
- B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, and accessories; see Sections 26 05 33.13 and 26 05 83.
- D. Mount machines and motors on vibration and acoustic isolators.
 1. Place on structural supports and bearing plates.

2. Securely fasten to building supports.
 3. Prevent lateral displacement.
- E. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
 - F. Install guide rails to allow for expansion and contraction movement of guide rails.
 - G. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
 - H. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
 - I. Fill hoistway door frames solid with grout; see Section 04 20 00.
 - J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime with two coats.
 - K. Machine Room Components: Clean and degrease; prime one coat, finish with one coat of enamel.
 - L. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
 - M. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI 1 will be performed at their discretion.
- C. Perform testing and inspection in accordance with requirements.
- D. Operational Tests:
 1. Perform operational tests in the presence of Owner and Architect.
 2. Test single elevator system by transporting at least 6 persons up from main floor to top floor landings during a five minute period.
 3. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
 - a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.

3.06 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove protective coverings from finished surfaces.
- C. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals for additional submittals.
- B. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

**SECTION 14 91 00
FACILITY CHUTES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Trash chutes.
- B. Sound Isolation.
- C. Sound Dampening.

1.02 REFERENCE STANDARDS

- A. ASTM A463/A463M - Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process 2022.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment 2019.
- D. UL (DIR) - Online Certifications Directory Current Edition.

1.03 SUBMITTALS FOR REVIEW

- A. See Section 01 30 00 - Administrative Requirements for additional requirements.
- B. Product Data: Manufacturer's printed data sheets on each component, indicating which options are provided.
 - 1. Include standard details and installation instructions for each pre-engineered chute system.
- C. Shop Drawings: Provide detailed layout of chute and components, indicating interface with structure, enclosing walls, and utilities; include the following:
 - 1. Openings in floors and required clearances.
 - 2. Location and size of each field connection to structure.
 - 3. Pipe sizes and locations.
 - 4. Electrical wiring sizes, conduits, and location of connections.
 - 5. Clearly indicate components required but not furnished by chute installer.
 - 6. Distinguish between factory fabrication and field-assembly work.
 - 7. Include layout and installation details with sections, elevations, and chute fabrication.
- D. Test Reports: Submit for each test/inspection.
- E. Certificates: Certify that chute assembly meets or exceeds NFPA 82 and other specified requirements.
- F. Executed warranty.

1.04 DOCUMENTATION FOR SITE INFORMATION

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

- B. Documentation for Site Information shall be provided on site by Contractor for use by Contractor, subcontractors and installers. Documentation submitted to Architect will not be reviewed.
- C. Retain the following documentation for site information:
 - 1. Manufacturer's Installation Instructions: Indicate component installation assembly.
 - 2. Coordination Drawings.
 - 3. Other types indicated.
- D. Documentation for Site Information maybe reviewed by Architect for reference.

1.05 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit following at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and Maintenance Data: Manufacturer's operation instructions.
 - a. Include control wiring diagrams.
 - 3. Warranties.
 - 4. Submittals for Site information.
 - 5. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
 - a. Sanitizing Solution or Chemicals for Cleaning Chute: 2 gallons, minimum.
 - 6. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for facility chutes. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Facility Chutes:
 - 1. Basis of Design: Century Chutes; : www.centurychutes.com.
 - 2. CHUTES International; Trash Chutes: www.chutes.com.
 - 3. Midland Chutes: www.midlandchutes.com.
 - 4. Wilkinson Hi-Rise: www.whrise.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FACILITY CHUTES

- A. Trash Chutes: Sheet metal, round, constant diameter extending from above roof to lowest floor, with chute intake doors at each floor and bottom of chute discharge door into designated room as indicated on drawings; comply with requirements of NFPA 82 and authorities having jurisdiction (AHJ).
 - 1. Chute Inside Diameter: 24 inches, minimum.

2. Intake Door Size: 15 inches wide by 18 inches high, nominal.
3. Provide electric interlock system and sensors that comply with the following:
 - a. Opening other chute intake doors at same time is not permitted.
 - b. Opening chute intake doors when temperature in chute exceeds predetermined, adjustable temperature is not permitted.
 - c. Opening chute intake doors while spray cleaning is in progress is not permitted.
4. Provide manual controls in discharge room to activate spray cleaning equipment inside trash chute.

2.03 COMPONENTS

- A. Chute: Factory-fabricated to the greatest extent possible, with continuously welded or lock-seamed joints and smooth, nonsnag interior; no protruding bolts, rivets, or hardware and no sharp edges or corners.
 1. Material: Aluminum-coated steel sheet complying with ASTM A463/A463M, CS Type B, with minimum T1-40/T1M-120 coating.
 2. Sheet Metal Thickness: 16 gauge, 0.06 inch.
 3. Fire Rating: As indicated on drawings.
 4. Chute Offsets: At maximum of 15 degrees and limited to one offset per two floors in accordance with NFPA 82.
 5. Throat Sections: Provide sloped throat sections for chute intake doors, of same material and construction as chute.
 6. Factory-coat outside of chute with sprayed sound-dampening material.
 7. Fabricate with support frames at each floor with sound isolator pads and expansion joints in chute between each support point.
 - a. Sound Isolator Pads: Provide manufacturer's standard; 1/4 inch top and bottom waffle design, oil resistant, neoprene with 3/8 inch close grained cork core
- B. Chute Intake Doors: Factory-assembled, UL (DIR) listed and labeled door and frame, with pneumatic opening and closing and positive latching; frame designed for chase construction, and flush-mounted.
 1. Material: Stainless steel, brushed or satin finish.
 2. Fire Rating: In compliance with local building code requirements.
 3. Chute intake doors shall not fail in a "door open" position in the event of a closer failure and shall be positive latching, remaining latched and closed in the event of latch spring failure during a fire emergency and if normally in the open position shall be automatic-closing by actuation of smoke detectors. Sections 716.5.9 and 716.5.9.1.1 (OSSC).
 4. Signs: Provide markings on frame or face of door that indicates purpose of chute; use engravings, integral raised lettering, or other permanent notation markings.
 5. Product:
 - a. Easy-Wave Electric Interlock by Century Chute.
- C. Chute Discharge Doors: Factory-assembled, UL (DIR) listed and labeled door and frame, with pneumatic opening and closing and positive latching, upon activation of smoke detector or fusible link; style as required for facility chute configuration indicated.
 1. Material: Aluminum-coated steel.
 2. Fire Rating: As indicated on drawings.
 3. Vertical Discharge Style: Inclined horizontally rolling shutter, closing by gravity.

- D. Chute Access Doors: Provide same construction and fire rating as chute intake doors with locks; provide wherever equipment requiring maintenance is located inside chute, including sprinklers, plumbing, and electrical connections.
- E. Chute Intake and Access Door Locks: Mortise or rim cylinder locks keyed alike; key removable only when door is locked.
- F. Roof Vent: Full diameter, extending at least 48 inches above roof level, with roof deck flange.
 - 1. Material: Manufacturer's standard.
 - 2. Provide counterflashing and clamping ring of nonferrous metal compatible with chute material; see Section 07 62 00.
 - 3. Provide roof termination vent unit in accordance with NFPA requirements with explosion release cap.
 - 4. Top Unit: Screened vent.
- G. Fire Suppression Sprinklers: Comply with requirements of NFPA 82 and NFPA 13; provide 1/2 inch NPS sprinkler heads mounted inside chute intake throats at following locations:
 - 1. At or above top intake opening.
 - 2. At lowest intake opening.
 - 3. In buildings of more than two stories, at every other floor.
- H. Spray Cleaning Equipment:
 - 1. Flushing Spray: Solenoid controlled 3/4 inch NPS hot water spray head mounted above top intake door.
 - 2. Sanitizing Unit: Tank and feeder to introduce disinfectant into flushing spray line.
 - a. Provide backflow preventer valve and actuator switch.
 - b. Capacity: 1 gallon, minimum.
 - c. Accessible through access door immediately above top intake door.
- I. Heat and Smoke Detector System: Interlock system with temperature-rise elements that locks chute doors when temperature in chute reaches a predetermined, adjustable temperature.
 - 1. Locate smoke detector outside discharge door with solenoid to close discharge door.
- J. Equip chute with an ionized odor control system.
- K. Electrical Controls: 110 VAC; see Section 26 05 83 for wiring connections.
- L. Pneumatic Operators: Compressed air units; provide compressor, air tubing, and control panel.

2.04 SOUND DAMPING AND ISOLATION

- A. Acoustics:
 - 1. Sound Dampening: Factory installed manufacturer's standard heavy mastic coating to help eliminate metallic reverberations.
 - 2. Isolator Pads: Manufacturer's standard heavy-duty pads installed under support to help eliminate sound transmission through structure.
- B. Isolator Pads:
 - 1. Product: Korfund.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Vibration Dampening Compound:
 - 1. Product: Daubert V-Damp 3680 Sound Coat.

2. Apply to exterior, full length of chute.
3. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 MAINTENANCE PRODUCTS

- A. See Section 01 60 00 for additional requirements.
- B. Sanitizing Solution or Chemicals: Two containers for Owner's use in cleaning chute.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install facility chutes and equipment in accordance with NFPA 82, requirements of local authorities having jurisdiction (AHJ), and manufacturer's instructions.
- B. Maintain fire-resistive capacity of enclosing walls.
- C. Install facility chute plumb and without offsets or obstructions that might prevent free fall of materials, except as indicated on drawings in compliance with requirements.
- D. Securely anchor chute components as required to withstand impact and weight of materials placed within chute.
- E. Sound Damping Duct Lagging: Wrap chute and overcap six (6) inches from floor to ceiling, tape horizontal and vertical joint continuously.
 1. Location: All floors except at trash compactor.
- F. Install roof vent flange to roof deck prior to installation of roofing.
- G. Install counterflashing after roofing installation.
- H. Adjust doors and other operating components for smooth operation.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Place bagged material of expected size in chute to verify free fall.
- C. Test facility chute components for proper operation.
 1. Operate doors, locks, and interlocks.
 2. Operate spray cleaning devices.
 3. Simulate fire conditions inside chute to verify sprinkler and detector operation.

3.03 DEMONSTRATION

- A. Demonstrate use of chute and safety features to Owner's personnel.
 1. Operate sanitizing equipment through one complete cycle of use and cleanup.
Demonstrate replenishment of chemicals or cleaning fluids in containers of unit.

3.04 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

- B. After completion of enclosing walls, clean exposed facility chute components; do not remove testing agency labels.

END OF SECTION

SECTION 21 00 00
BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 GENERAL

1.01 PROJECT DESCRIPTION

- A. It is expected that each of the individual Design-Build subcontractors will evaluate this information, provide additional recommendations/input, and be responsible for the final design throughout the design-build process.

1.02 DESCRIPTION OF WORK

- A. Design Drawings:
 - 1. Base Drawings: Architect will furnish electronic copies of floor, ceiling, and roof plans for background of mechanical design drawings.
 - 2. Design Drawings: Develop fire protection design drawings prior to starting work. Coordinate with architectural ceiling layout drawings.
- B. Design Requirements for Fire Protection Systems: (Starting at 5 feet outside the building.)
 - 1. Sprinkler System Type: Combination wet and dry pipe.
 - 2. Sprinkler System Design: Sprinkler installer shall hydraulically engineer the sprinkler system to meet design requirements of NFPA13 and local Fire Marshal.
 - 3. Stand Pipe: As indicated on drawings, per NFPA14 and AHJ.
 - 4. Pumper Connection: As indicated on drawings.
- C. Performance Requirements:
 - 1. Code Requirements: Comply with requirements of State and Local regulatory agencies.
 - 2. Permit, Plan Check, and Inspection Fees: Arrange and pay fees for fire sprinkler plan check, and special inspection required by regulatory agencies and utilities for work in this Division.
 - 3. Continuous Service: Maintain continuous temporary water service to the standpipes until Substantial Completion.
- D. Product Submittals:
 - 1. Submit two copies of product data for fire sprinkler equipment, including but not limited to pipe, valves, fittings, sprinkler heads, and similar system components.
 - 2. Indicate the exact item to be furnished and reference to Section, Article, and Paragraph where the item is specified.
- E. Quality Assurance Submittals:
 - 1. Submit two copies of fire protection design drawings.
 - 2. Submit two copies of shop drawings fully coordinated with all Mechanical, Electrical, and Plumbing components.
 - a. Content and View: Two views, concealed conditions and visually exposed conditions, shown as reflected plans. Indicate actual size of components at scale sufficient to show no interference and adequate space for installation and maintenance of each component.
 - b. Overlay drawings by mechanical showing all Mechanical, Electrical, and Plumbing systems. Coordinate until all conflicts are resolved. Provide single point of overlaying.
- F. Project Record Documents: Comply with requirements of Section 01 33 00 - Submittal Procedures and Section 01 70 00 - Execution and Closeout Requirements.
- G. Project Record Documents: Comply with requirements of Section 01 30 00 - Administrative Requirements and Section 01 78 00 - Closeout Submittals.
- H. Operation and Maintenance Data: Comply with Section 01 78 00 - Closeout Submittals.

- I. Manufacturer's Warranty: Submit two signed copies of manufacturer's standard limited warranty for each item where a warranty is specified in this Division.
- J. Installer's Warranty:
 - 1. Furnish two copies of installer's limited warranty against defects in labor for a period of one year from the date of Substantial Completion.
 - 2. Installer shall correct defects in Fire Sprinkler systems and equipment which occur within the one year warranty period.
- K. Maintenance Service: Maintain equipment and systems in operating condition until Substantial Completion. Furnish spare parts for items requiring replacement within one year.

1.03 PERFORMANCE

- A. Protection: Protect existing wall & ceiling systems and finishes during installation of mechanical work.
- B. Cutting and Patching for Fire Sprinkler work by others.
- C. Trenching, Backfilling, and Compacting for Mechanical Work by others:
 - 1. Provide trenching, backfilling, and compacting for mechanical systems.
 - 2. Barricade and cover open trenches until backfilled.
- D. Installation of Mechanical Equipment and Systems:
 - 1. Assemble, install, connect, and protect equipment and systems in accordance with manufacturers printed instructions.
 - 2. Connect to water lines as directed by the serving utility.
 - 3. Connect to water lines 5 feet from building perimeter.

1.04 FIRE SPRINKLER SYSTEM DESIGN CRITERIA

- A. System Description:
 - 1. Size system to provide coverage for entire building(s).
 - 2. Determine volume and pressure of incoming water supply. If water pressure is not available assume 2000 gpm at 20 psig. Revise design when test data is available prior to submittals.
 - 3. Coordinate system with building controls system and building fire and smoke alarm system. Panels, wiring and connections are in Division 26 00 00.
 - 4. Design and materials to conform with UL and/or FM Global.
 - 5. Basis of design to be per NFPA 13 with semi-recessed sprinkler heads in all areas.
 - 6. Dry system as required for areas subject to freezing.
 - 7. Provide stand pipe design per NFPA 14. Provide stand pipes and hose connections at each side of horizontal exits.
 - 8. Interior backflow assemblies and building or yard mounted FDC per Fire Marshal requirements.
 - 9. No fire pump anticipated.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements.

END OF SECTION

**SECTION 21 05 00
 FIRE PROTECTION BASIC MATERIALS AND METHODS**

PART 1 GENERAL

1.01 SUBMITTALS FOR REVIEW

- A. See Section 01 33 00 Submittal Procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
- D. Submit shop drawings, product data and hydraulic calculations to Fire Marshal for approval. Submit proof of approval to Architect/Engineer.

PART 2 PRODUCTS

2.01 BURIED PIPING

- A. Centrifugally cast Class 52 ductile iron pipe: ANSI/AWWA C151.
 - 1. Fittings: ANSI/AWWA C110, standard thickness.
 - 2. Joints: ANSI/AWWA C111, rubber gasket.
 - 3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock "C" shaped composition sealing gasket, steel bolts, nuts and washers; galvanized for galvanized pipe.
 - 4. Acceptable manufacturer: Tyler, American Cast Iron Co., U.S. Pipe.

2.02 ABOVE GROUND PIPING (THROUGH 2 INCH)

- A. Steel Pipe: ASTM A135/A795 UL listed, threadable, light wall.
 - 1. Cast Iron Fittings: ASME B16.4, threaded fittings.
 - 2. Malleable Iron Fittings: ASME B16.3, threaded fittings.
 - 3. Acceptable Manufacturer: American Tube "Dyna-Thread"; Allied.

2.03 RESIDENTIAL SPRINKLER PIPE AND FITTINGS

- A. UL and FM listed CPVC pipe and fittings listed for high rise building sprinkler systems as manufactured by "BlazeMaster," or approved.

2.04 SPRINKLERS

- A. Manufacturers: Reliable, Star, Viking.

Building Area	Sprinkler	Sprinkler Finish	Escutcheon Finish	Temperature Degree
Unfinished Areas, Office, Garage and Mechanical Rooms	Upright/Pendant Viking Model M Microfast	Brass	None	155° F
Electrical, Telephone and Switchgear Rooms	Upright Viking Model M	Brass	None	286° F

Finished Ceilings	Extended Coverage Semi-Recessed	White	White	165° F
Dwelling Units	Extended Coverage Semi-Recessed	White	White	155° F
Soffits	Semi-Recessed Sidewall	White	White	155° F
Balconies	Dry Pendent Sidewall, corrosion resistant	Brass	Chrome	155° F

2.05 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.
- B. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch. Potter-Roemer Fig. 6230 or approved equal.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC. Grinnell Model VSR-I.
- D. Supervisory Switches: As manufactured by Grinnell OSYSU-1 or OSYSU-2, Potter-Roemer Fig. 6220, or approved equal.
- E. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with accelerator, with test and drain valve.
- F. Air Compressor: Single unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve. Refer to Division 16 for electrical characteristics.

2.06 FLEXIBLE SPRINKLER HOSE FITTINGS

- A. FlexHead Industries flexible sprinkler connections.

2.07 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
- C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- D. Vertical Support: Steel riser clamp or angle ring.
- E. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.08 GATE VALVES

- A. Up to and including 2 inches:
 - 1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.
- B. Over 2 inches:
 - 1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.
- C. Over 4 inches:

1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.09 BALL VALVES

- A. Up to and including 2 inches:
 1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.
- B. Over 2 inches:
 1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10 inches and over, flanged.

2.10 CHECK VALVES

- A. Up to and including 2 inches:
 1. Bronze body and swing disc, rubber seat, threaded ends.
- B. Over 2 inches:
 1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
- C. 4 inches and Over:
 1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Provide oversize escutcheons or flexible connections as directed by the Architect to allow for seismic movement.
- B. Flush piping system and hydrostatically test.

END OF SECTION

**SECTION 21 12 00
STANDPIPES AND FIRE HOSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Standpipe system.
- B. Fire department connection.

1.02 RELATED REQUIREMENTS

- A. Section 21 00 00 - Basic Fire Suppression Requirements
- B. Section 21 05 00 - Fire Protection Basic Materials and Methods: Fire protection piping.

1.03 REFERENCE STANDARDS

- A. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2010.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.
- C. Shop Drawings: Indicate supports, components, accessories, and sizes. Shop drawings shall be minimum 36 x 24 size.
 - 1. Submit shop drawings and product data to Owner's insurance underwriter for approval.
 - 2. Submit proof of approval to Architect.
- D. Project Record Documents: Record actual locations of components.
- E. Operation Data: Include manufacturer's data.
- F. Maintenance Data: Include servicing requirements and test schedule.
- G. Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 63 00 - Product Substitution Requirements, for additional provisions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in shipping packaging until installation.

PART 2 PRODUCTS

2.01 FIRE DEPARTMENT CONNECTION

- A. Type: Free standing type with ductile iron pedestal red enamel finish.
- B. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
- C. Drain: 3/4 inch automatic drip, connected to drain.
- D. Label: "Standpipe - Fire Department Connection".

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 14.
- C. Connect standpipe system to water source ahead of domestic water connection.
- D. Provide two way fire department outlet connection on roof.
- E. Flush entire system of foreign matter.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with local requirements and project specifications.
- B. Test entire system in accordance with NFPA 14.
- C. Test shall be witnessed by Fire Marshal.

END OF SECTION

SECTION 22 00 00
BASIC PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 PROJECT DESCRIPTION

- A. It is expected that each of the individual Design-Build subcontractors will evaluate this information, provide additional recommendations/input, and be responsible for the final design throughout the design-build process.

1.02 DESCRIPTION OF WORK

- A. Design Drawings:
 - 1. Base Drawings: Architect will furnish electronic copies of floor, ceiling, and roof plans for background of mechanical design drawings.
 - 2. Design Drawings: Develop plumbing design drawings prior to starting work. Coordinate with architectural ceiling layout drawings.
- B. Design Requirements for Plumbing Systems: Design plumbing systems to UPC requirements using ASPE and IAMPO Standards.
- C. Design Requirements for Domestic Water Systems:
 - 1. Local water utility will provide underground line to water meter at edge of property as indicated on Site Plan.
 - 2. Design water system starting 5 feet from building perimeter. Does not include city tap.
- D. Design Requirements for Sanitary Sewer Systems:
 - 1. Obtain information from local sewer utility on requirements to connect to existing sanitary sewer.
 - 2. Design sanitary sewer system starting 5 feet from building perimeter. Does not include city tap.
- E. Design Requirements for Storm Sewer Systems:
 - 1. Obtain information from local sewer utility on requirements to connect to existing storm sewer.
 - 2. Design storm sewer system starting 5 feet from building perimeter. Does not include city tap.
 - 3. Connect to storm water retention system.
- F. Design Requirements for Natural Gas System:
 - 1. Owner to Contact NW Natural Gas and arrange and pay for new gas service and meters to the building as necessary.
 - 2. Individual meter to be provided for all house equipment.
 - 3. Contractor to Provide NW Natural Gas with all required load information.
 - 4. Contractor to Design natural gas system starting at the meters.
- G. Performance Requirements:
 - 1. Code Requirements: Comply with requirements of State and Local regulatory agencies.
 - 2. Permit, Plan Check, and Inspection Fees: Arrange and pay fees for natural gas and plumbing permit, plan check, and special inspection required by regulatory agencies and utilities for work in this Division.
 - 3. Continuous Service: Maintain continuous temporary water service to all areas of the site until Substantial Completion.
- H. Product Submittals:

1. Submit electronic copies of product data for plumbing equipment, including but not limited to fixtures, faucets, valves, fittings, cleanouts, and similar system components.
2. Indicate the exact item to be furnished and reference to Section, Article, and Paragraph where the item is specified.
- I. Quality Assurance Submittals:
 1. Submit electronic copies of plumbing design drawings.
 2. Submit electronic copies of shop drawings fully coordinated with all Mechanical, Electrical, and Fire components.
 3. Content and View: Two views, concealed conditions and visually exposed conditions, shown as reflected plans.
 - a. Indicate actual size of components at scale sufficient to show no interference and adequate space for installation and maintenance of each component.
 - b. Overlay drawings by mechanical showing all Mechanical, Electrical, and Fire systems. Coordinate until all conflicts are resolved. Provide single point of overlaying.
- J. Project Record Documents: Comply with requirements of Section 01 33 00 - Submittal Procedures and Section 01 70 00 - Execution and Closeout Requirements
- K. Operation and Maintenance Data: Comply with Section 01 78 00 - Closeout Procedures.
- L. Manufacturer's Warranty: Submit two signed copies of manufacturer's standard limited warranty for each item where a warranty is specified in this Division.
- M. Installer's Warranty:
 1. Furnish two copies of installer's limited warranty against defects in labor for a period of one year from the date of Substantial Completion.
 2. Installer shall correct defects in Mechanical systems and equipment which occur within the one year warranty period.
- N. Maintenance Service: Maintain equipment and systems in operating condition until Substantial Completion. Furnish spare parts for items requiring replacement within one year.

1.03 PERFORMANCE

- A. Protection: Protect existing wall & ceiling systems and finishes during installation of mechanical work.
- B. Cutting and Patching for Plumbing work.
- C. Trenching, Backfilling, and Compacting for Mechanical Work:
 1. Provide trenching, backfilling, and compacting for mechanical systems.
 2. Barricade open trenches until backfilled.
- D. Installation of Mechanical Equipment and Systems:
 1. Assemble, install, connect, and protect equipment and systems in accordance with manufacturers printed instructions.
 2. Connect to water, sewer and natural gas lines as directed by the serving utility.
 3. Connect to water, sewer and natural gas lines 5 feet from building perimeter.

1.04 PLUMBING SYSTEM DESIGN CRITERIA

- A. General:
 1. Size Cold Water piping for maximum 8 fps maximum velocity or per Acoustical Engineer's requirements.
 2. Size Hot Water piping for maximum 6 fps maximum velocity.
 3. Provide minimum 35 psig at most remote fixture with domestic water booster pumps.
 4. Design piping to absorb building shrinkage without creating excessive stress to piping system. Assume 3/8" per floor for wood construction.

5. Insulate hot and cold water. See Section 22 07 19.
 6. Building water supply use Type K copper with tracer wire below grade. Use Type L copper or rigid PEX (2" and smaller) for horizontal mains. Use copper piping in all exposed areas.
 7. Building waste drainage below grade piping; PVC. See Section 22 10 05.
 8. Design build storm drainage with internal drains and overflows down to street. Use cast iron and insulate all horizontal piping and drain bodies. Overflow drains to terminate at grade level.
 9. Cast iron downspout boots with cleanout.
 10. Below grade storm drains PVC.
 11. No exposed PVC.
 12. Schedule 40, threaded steel, natural gas piping.
 13. Gas piping and connection for all water heaters, rooftop units, and amenity appliances.
 14. Waste, vent, and water pipe to be isolated from structure with minimum 1/4" material equivalent to Hubbard Holdrite Silencer Series Felt 272-2. All vertical clamps to use neoprene pads equivalent to Hubbard Silencer Series 276.
 15. Provide chrome plated rigid or flexible supplies to fixtures with stops, reducers, and escutcheons.
 16. Provide trap primers and piping for floor drains, floor sinks, and all fixtures needing trap seals.
 17. Provide Radon mitigation for all ground floor living units per OSSC requirements.
 18. Heat trace all piping and p-traps exposed to freezing.
 19. Run all HVAC condensate to over flow drains/sinks. Piping to be PVC.
 20. Reduced pressure backflow assembly inside the building for main water service.
- B. Apartment Units:
1. Central condensing gas, high efficiency water heaters with recirculation, sized per ASHRAE guidelines, but not less than 5 gph/unit. Recirculation system to function independent of building occupancy.
 2. PEX risers to dwelling units with shutoffs located behind access panel.
 3. PEX piping for domestic water inside apartments.
 4. Provide water supply and shut-off valve for refrigerator ice maker.
 5. Provide braided hose connection for washers.
 6. PVC waste piping for horizontal and Cast Iron vertical at living units. Cast iron above all common areas.
 7. PVC piping for all vent.
- C. Common Areas (Apartment Buildings):
1. Use central gas water heaters with recirculation.
 2. Route water heater flues and intakes to exterior.
 3. Provide PEX domestic water piping to point of fixture rough-in.
 4. Provide service isolation valves for all plumbing fixture groups.
 5. Below grade piping PVC.
 6. Provide gas piping to outdoor BBQ and fire pits and cooking appliances. (Total of 6).
 7. Provide exterior freeze proof wall hydrants on main entries on building perimeter (Total of 18) Provide freeze proof hydrants at roof. (Total of 4).
 8. Provide hot and cold interior hydrant in the Trash room and other areas. (Total of 3)
 9. Run all HVAC condensate to over floor drains/sinks.

10. Provide water to trash chute point of connection. Provide drain for trash chute. Architect locates drains.
 11. Provide elevator sump pumps and discharge to State approved location.
- D. Clubhouse:
1. Tank type electric water heater.
 2. PEX water piping to rough in.
 3. PVC waste and vent.
 4. Schedule 40 gas piping.
 5. Provide exterior freeze proof wall hydrants on building perimeter (Total of 2)
 6. Provide reduced pressure backflow device and route piping to point of connection for pool equipment. Drain and gas piping for pool equipment room. Coordinate location and size with pool contractor.
- E. Retail:
1. Provide 4" waste routed through the back of the space for future connection.
 2. Provide 4" grease waste routed through the back of the space for future connection. Exterior 100 gpm hydromechanical grease interceptor.
 3. Provide 3" VTR (Total of 2) for future tenant.
 4. PVC waste and vent.
 5. Building water supply use Type K copper below grade. Use Type L copper above grade.
 6. Provide reduced pressure backflow assembly for premise isolation.
 7. Route 2" water main with stub, shut-off valve, and submeter for future tenants (Total of 2)
 8. Schedule 40 gas piping. Bring gas to building with location for 2 future meters. Route gas piping inside building with shut off for future tenants (Total of 2).
- F. Plumbing Fixtures:
1. Plumbing fixtures per Architect/General Contractors typical fixture package. See Exhibit 4 of the design build request for proposal documents.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements.

END OF SECTION

**SECTION 22 05 49
PLUMBING SEISMIC RESTRAINT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Seismic restraint of equipment and piping.

1.02 RELATED SECTIONS

- A. Section 22 00 00 - Basic Plumbing Requirements.
- B. Section 22 07 19 - Plumbing Piping Insulation.
- C. Section 22 10 05 - Plumbing Piping.
- D. Section 22 30 00 - Plumbing Equipment.
- E. Section 22 40 00 - Plumbing Fixtures.

1.03 QUALITY ASSURANCE

- A. Seismic Restraints:
 - 1. The anchorage and/or seismic restraint of permanent equipment and associated systems listed below shall be designed to resist the total design seismic forces prescribed in the latest edition of the International Building Code.
 - a. All floor or roof-mounted equipment weighing 400 lbs or greater.
 - b. All suspended or wall-mounted equipment weighing 20 lbs or greater.
 - c. All vibration-isolated equipment weighing 20 lbs or greater.
 - d. All gas piping systems throughout the building.
 - e. All piping 1 1/4 inches nominal diameter and larger located in boiler, mechanical equipment and refrigeration mechanical rooms.
 - f. All piping 2 1/2 inches nominal diameter and larger.
 - g. Pipes, electrical conduit and ducts supported by a trapeze where none of those elements would individually require bracing, require bracing when the combined operating weight of all elements supported by the trapeze is 10 lbs/ft or greater.
- B. All calculations shall be in accordance with Chapter 16 of the latest edition of the International Building Code.

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00:
 - 1. All anchorage and seismic restraints shall be designed and stamped by a professional engineer licensed in the state of the project location. Design shall include:
 - a. Number, size and location of anchors for floor or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. In addition, provide calculations or test data verifying the curb can accept the seismic loads.
 - b. Number, size and location of seismic restraint devices and anchors for vibration-isolated and suspended equipment. Provide calculations or test data verifying the horizontal and vertical ratings of the seismic restraint devices.
 - c. Number, size and location of braces and anchors for suspended piping and ductwork on shop drawings. In addition:
 - 1) The contractor must select a single seismic restraint system pre-designed to meet the requirements of the latest edition of the International Building Code such as the 1999 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork and Electrical Systems.

- 2) Details or designs from separate seismic restraint guidelines are not acceptable. Installations not addressed by the selected system must be designed, detailed and submitted along with the shop drawings.
- 3) Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional engineer licensed in the state of the project location who designed the layout of the braces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Amber Booth.
- B. Mason Industries, Inc.
- C. Kinetics Corporation.
- D. Vibrex.
- E. Substitutions: Under provisions of Section 01 63 00.

2.02 SEISMIC RESTRAINTS

- A. General Requirements:
 1. Seismic restraints shall be provided for all equipment, both supported and suspended, piping and ductwork as listed above.
 2. Bracing of piping and ductwork shall be in accordance with provisions set forth in SMACNA seismic restraint manual.
 3. Structural requirements for restraints, including their attachment to building structure, shall be reviewed and approved by the structural engineer.
 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.
- B. Supported Equipment Products:
 1. Seismic restraints shall consist of interlocking steel members restrained by shock absorbent neoprene materials compounded to bridge bearing specifications as previously noted in paragraph 1.03. Elastomeric materials shall be replaceable and be a minimum 3/4-inch thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8-inch, nor more than 1/4-inch. Type 1 - Seismic Snubbers: All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 inch thick. A minimum air gap of 1/8 inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. The snubber shall be designed to accept horizontal and vertical seismic loads as defined in Section 1.03.B. Mason Type Z-1225 or Z-1011.
 2. Each snubber shall be capable of restraint in all three mutually orthogonal directions. Type 2 - Seismic Sway Braces - Seismic sway braces shall consist of galvanized steel aircraft cables or steel angles/channels. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel to the final installation angle. Do not mix cable and steel braces to brace the same system or equipment. Steel angles, when required, shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps. Sway braces shall be designed to accept horizontal

- and vertical seismic loads as defined in Section 1.03.B. Mason Type SCB, SSB, SRC and UC.
3. Submittals shall include load versus deflection curves up to 1/2-inch on the x, y and z planes.
 4. Mason Model Z-1011.
- C. Bracing of Pipes:
1. Provide seismic bracing of all piping as detailed below. (Exception: Piping suspended by individual hangers 12 inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced).
 - a. Brace all gas piping.
 - b. Brace all piping located in boiler rooms, mechanical equipment rooms, and refrigeration mechanical rooms that is 1-1/4-inch nominal diameter and larger.
 - c. Brace all pipes 2-1/2-inch nominal diameter and larger.
 2. For all gas piping, as specified in 1(a) the bracing details, schedules, and notes may be used, except that transverse bracing shall be at 20 feet maximum, and longitudinal bracing shall be at 40 feet maximum.
 3. Seismic braces for pipes on trapeze hangers may be used.
 4. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, the flexibility may be provided by the installation of swing joints.
 5. Cast iron pipe of all types, glass pipe, and any other pipe jointed with a shield and clamp assembly, where the top of the pipe is 12 inches or more from the supporting structure, shall be braced on each side of a change in direction of 90 degrees or more. Riser joints shall be braced or stabilized between floors.
 6. Vertical risers shall be laterally supported with a riser clamp at each floor. For buildings greater than six stories high, all risers shall be engineered individually.
- D. Suspended Equipment and Piping:
1. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable and the specified vibration isolation hanger with an added nut and neoprene and steel washer. The cable resists lateral and downward motion. The modified vibration hanger resists upward motion.
 2. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and are to be indicated in the Shop Drawings.
 3. Provide detailed Shop Drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

PART 3 EXECUTION

3.01 SEISMIC RESTRAINTS

- A. General:
1. Install and adjust seismic restraints so that the equipment, piping, and ductwork supports are not degraded by the restraints.
 2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- B. Supported Equipment:
1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.

2. Care must be taken so that a minimum 1/8-inch air gap in the seismic restraint snubber is preserved on all sides in order that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.
- C. Bracing of Pipes:
1. Branch lines may not be used to brace main lines.
 2. Transverse bracing shall be at 40 feet maximum except where a lesser spacing is indicated in the SMACNA tables for bracing of pipes.
 3. Longitudinal bracing shall be at 80 feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity equal to or greater than a longitudinal brace. The longitudinal braces and connections must be capable of resisting the additional force induced by expansion and contraction.
 4. A rigid piping system shall not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.
 5. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24 inches of the elbow or tee.
- D. Suspended Equipment and Piping Cable Method:
1. Cables shall be adjusted to a degree of slackness approved by the Structural Engineer.
 2. Uplift and downward restraint nuts and washers for the Type HST hangers shall be adjusted so that there is a minimum 1/4-inch clearance.

END OF SECTION

**SECTION 22 07 19
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible elastomeric cellular insulation.
- B. Piping insulation.
- C. Jackets and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.
- B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

1.04 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. See Section 01 35 15.13 - LEED Submittal Requirements.
- C. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- D. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 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 three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 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 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. Knauf Insulation; Model "Pipe Insulation ASJ-SSL": www.knaufusa.com.
 - 2. Johns Manville Corporation; Model "Micro-Lok": www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation: www.certainteed.com.

5. Substitutions: See Section 01 63 00.
- B. Insulation: ASTM C547 ; 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 ; 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.
- D. 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.
- E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- F. Vapor Barrier Lap Adhesive:
 1. Compatible with insulation.
- G. Insulating Cement/Mastic:
 1. ASTM C195; hydraulic setting on mineral wool.
- H. Indoor Vapor Barrier Finish:
 1. Cloth: Untreated; 9 oz/sq yd weight.
 2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- I. Outdoor Vapor Barrier Mastic:
 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- J. Outdoor Breather Mastic:
 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- K. Insulating Cement:
 1. ASTM C449/C449M.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 1. Armacell International; Model "Armaflex II": www.armacell.com.
 2. Halstead; Model "Insul-Tube".
 3. Substitutions: See Section 01 63 00.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 1; use molded tubular material wherever possible.
 1. Minimum Service Temperature: -40 degrees F.
 2. Maximum Service Temperature: 220 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.

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. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.

- D. Insulated pipes conveying fluids below ambient temperature: 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.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

3.03 SCHEDULES

- A. Plumbing Systems:
 - 1. Domestic Hot Water Supply:
 - a. Glass Fiber, Rigid, Insulation:
 - 1) Pipe Size Range: Under 2 inch.
 - 2) Thickness: 1 inch.
 - 3) Pipe Size Range: Over 2 inch.
 - 4) Thickness: 1 inch.
 - 2. Domestic Hot Water Recirculation:
 - a. Glass Fiber, Rigid, Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch.
 - 3. Domestic Cold Water:
 - a. Glass Fiber, Rigid, Insulation:
 - 1) Pipe Size Range: 2 inches and over.
 - (a) Thickness: 1/2 inch.
 - 2) Pipe Size Range: 2 inches and under.
 - (a) No insulation required.
 - 4. Roof Drain Bodies: Flexible Duct Wrap with multi-purpose, foil-scrim-kraft jacket. Use tie-wire to secure in place. Minimum thickness: 1 inch.
 - 5. Roof Drainage Above Grade:
 - 6. Roof Drainage Within 10 Feet of the Exterior:
 - a. Glass Fiber, Rigid, Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch.
 - 7. Roof Drainage Run Horizontal at Roof Level:
 - a. Glass Fiber, Rigid, Insulation:

- 1) Pipe Size Range: All sizes.
- 2) Thickness: 1 inch.

END OF SECTION

**SECTION 22 10 05
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Storm water.
 - 4. Flanges, unions, and couplings.
 - 5. Pipe hangers and supports.
 - 6. Ball valves.
 - 7. Valves.
 - 8. Flow controls.
 - 9. Check.
 - 10. Water pressure reducing valves.
 - 11. Relief valves.
 - 12. Strainers.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 08 31 00 - Access Doors and Panels.
- C. Section 09 90 00 - Painting and Coating.
- D. Section 22 05 49 - Plumbing Seismic Restraint.
- E. Section 22 07 19 - Plumbing Piping Insulation.
- F. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.
- G. Section 31 20 00 - Earth Moving.

1.03 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- D. ASME B31.9 - Building Services Piping; 2014.
- E. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- F. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
- G. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- H. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2011).
- I. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.
- J. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- K. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- L. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.
- M. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

- N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- O. AWWA C651 - Disinfecting Water Mains; 2005.
- P. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.
- Q. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.
- R. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.
- S. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.
- T. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.
- U. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.
- V. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.
- W. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

1.04 SUBMITTALS

- A. See Section 01 33 00 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. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with all applicable local codes and standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME (BPV IX) .
- D. Identify pipe with marking including size, ASTM material classification, ASTM specification, water pressure rating.

1.06 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with applicable plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

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. Store pipe on sleepers, a minimum of 4 inches above surrounding grade, at all times.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665 or ASTM D3034. (Solid Wall)
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.02 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.
 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- B. PVC Pipe: ASTM D2729. (Solid Wall)
1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: ASTM B 88, Type K annealed.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 2. Joints: AWS A5.8, BCuP silver braze.

2.04 WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: ASTM B32, alloy Sn95 solder.
- B. PEX Tube: ASTM F 876, SDR 9.
1. Fittings: ASTM F 877, insert type with plastic compression type matching tube dimensions.
 2. Manifold: ASTM F 877, multi-outlet, corrosion resistant plastic assembly with valve for each outlet.
 3. Manufacturer: Engineered Plastic.

2.05 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
 2. Joints: CISBI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.06 STORM WATER PIPING, BELOW GRADE

- A. PVC Pipe: ASTM D2665.
1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches 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 Size 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. Dielectric Connections: Bronze threaded nipple, minimum 3 inches long, with impervious isolation liner. Victaulic "Clearflow".

2.08 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
1. Tolco Inc.
 2. Anvil.
 3. Hubbard Enterprises/Holdrite.
 4. Michigan Hanger Company, Inc.
 5. PHD Manufacturing Co.
 6. Superstrut.

7. Unistrut.
8. Substitutions: See Section 01 63 00.
- B. Plumbing Piping - Drain, Waste, and Vent:
 1. Conform to ASME B31.9.
 2. Hangers for Pipe Sizes 1/2 Inch to 4 inches: Malleable iron, loop hangers.
 3. Hangers for Pipe Sizes 6 Inches and Over: Clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
 1. Conform to ASME B31.9.
 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
 5. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
 6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
 8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
 10. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
 11. Vertical Support: Steel riser clamp.
 - a. Isolate riser clamp from structure by use of Hubbard Enterprises/Holdrite #274 or #278 riser pad or Owner-approved equivalent.
 12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
 14. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
 15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 16. Use non-metallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
 17. For vertical midspan support of piping 4 inches and under, use Hubbard Enterprises/Holdrite Stout Bracket in conjunction with Hubbard Enterprises/Holdrite Stout Clamp or industry standard two-hole pipe clamp (MSS Type 26).

18. Secondary Pipe Positioning and Supports:
 - a. Makeshift, field-devised methods of plumbing pipe support, such as the use of scrap framing materials, are not allowed. Support and positioning of piping shall be by means of engineered methods that comply with IAPMO PS 42-96. These are to be Hubbard Enterprises/Holdrite support systems or approved equal.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
 6. Other Types: As required.
 7. Manufacturers:
 - a. Powers Fasteners, Inc: www.powers.com.
 - b. Substitutions: See Section 01 63 00.

2.09 ACCESSORIES

- A. Hanger Rods: Mild steel, threaded both ends, threaded on one end, or continuous threaded.

2.10 INSERTS

- A. Manufacturers:
 1. Anvil Fig. 281.
 2. PHD Fig 951.
 3. Michigan Hanger Model 355EG.
 4. Substitutions: See Section 01 63 00.
- B. Inserts: Carbon steel 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.

2.11 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
 1. Waterproofing: 5 lb./sq.ft. sheet lead
 2. Soundproofing: 1 lb./sq.ft. sheet lead.
- D. Flexible Flashing: 1.85 inch thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.12 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 1. Thunderline Link-Seal, Inc. Model Series LS.
 2. NMP Corporation.
 3. Substitutions: See Section 01 63 00.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.13 FORMED STEEL CHANNEL

- A. Manufacturers:

1. Unistrut Model Series P1000.
 2. Superstrut Model Series 1200.
 3. Michigan Hanger "O-Strut" Model A-12.
 4. Substitutions: See Section 01 63 00.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.14 FIRESTOPPING

- A. Manufacturers:
1. Specified Technology Inc. (STI) Model SpecSeal Series 100.
 2. Dow Corning Corp.
 3. Hilti Corp.
 4. International Protective Coating Corp.
 5. 3M fire Protection Products.
 6. Substitutions: See Section 01 63 00.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single or multiple component silicone elastomeric compound and compatible silicone sealant.
 2. Foam Firestopping Compounds: Single or Multiple component foam compound.
 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
 5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 7. Firestop Pillows: Formed mineral fiber pillows.
- C. Color: As selected from manufacturer's full range of colors.

2.15 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
1. Mineral fiberboard.
 2. Mineral fiber matting.
 3. Sheet metal.
 4. Plywood or particle board.
 5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
1. Furnish UL listed products.
 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.16 GATE VALVES

- A. Manufacturers:
 1. Hammond Valve Co.; Model IB640: www.hammondvalve.com.
 2. Nibco, Inc.; Model T-111: www.nibco.com.
 3. Milwaukee Valve Company; Model 148: www.milwaukeevalve.com.
 4. Stockham; Model B-100: www.stockham.com.
 5. Substitutions: See Section 01 63 00.
- B. Up To and Including 3 Inches:
 1. MSS SP-80, Class 150, bronze body, bronze trim, rising stem, threaded bonnet, handwheel, inside screw, solid wedge disc, solder or threaded ends.

2.17 BALL VALVES

- A. Manufacturers:
 1. Hammond Valve Co.; Model 8501: www.hammondvalve.com.
 2. Nibco, Inc.; Model T-FP-600: www.nibco.com.
 3. Watts; Model FBV-1: www.watts.com.
 4. Stockham; Model S216-BR-R-T: www.stockham.com.
 5. Apollo; Model 70-100: www.conbraco.com.
 6. Milwaukee Valve Company; Model BA-125: www.milwaukeevalve.com.
 7. Substitutions: See Section 01 63 00.
- B. Up to and including 3 inches:
 1. MSS SP 110, Class 150, 600 WOG, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle solder or threaded ends.

2.18 FLOW CONTROLS

- A. Manufacturers:
 1. ITT Bell & Gossett: www.bellgossett.com.
 2. Griswold Controls: www.griswoldcontrols.com.
 3. Taco, Inc: www.taco-hvac.com.
 4. Substitutions: See Section 01 63 00.
- B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.19 SWING CHECK VALVES

- A. Manufacturers:
 1. Hammond Valve; Model IB940: www.hammondvalve.com.
 2. Nibco, Inc.; Model T-413: www.nibco.com.
 3. Stockham; Model B-320: www.stockham.com.
 4. Milwaukee Valve Company; Model F-2974: www.milwaukeevalve.com.
 5. Substitutions: See Section 01 63 00.
- B. Up to 3 Inches:

1. 1, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.
- C. Over 3 Inches:
 1. MSS SP-71, Class 125, iron body, bronze fitted, renewable disc seal and seat, flanged ends.

2.20 SPRING LOADED CHECK VALVES

- A. Manufacturers:
 1. Hammond Valve; Model IR9354: www.hammondvalve.com.
 2. Nibco, Inc.; Model F-910: www.nibco.com.
 3. Milwaukee Valve Company; Model Series 1800: www.milwaukeevalve.com.
 4. Substitutions: See Section 01 63 00.
- B. Class 125, globe style, iron body, bronze trim, stainless steel springs, bronze disc, seals, lug style ends.

2.21 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
 1. Watts Regulator Company: www.wattsregulator.com.
 2. Cash-Acme: www.cashacme.com.
 3. Zurn/Wilkins: www.zurn.com.
 4. Substitutions: See Section 01 63 00.
- B. Up to 2 Inches:
 1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
- C. Over 2 Inches:
 1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.22 RELIEF VALVES

- A. Pressure Relief:
 1. Manufacturers:
 - a. Watts Regulator Company: www.wattsregulator.com.
 - b. Cash-Acme: www.cashacme.com.
 - c. Zurn/Wilkins: www.zurn.com.
 - d. Substitutions: See Section 01 63 00.
 2. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure Relief:
 1. Manufacturers:
 - a. Watts Regulator Company: www.wattsregulator.com.
 - b. Cash-Acme: www.cashacme.com.
 - c. Zurn/Wilkins: www.zurn.com.
 - d. Substitutions: See Section 01 63 00.
 2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

2.23 STRAINERS

- A. Manufacturers:
 1. Watts Regulator Company: www.wattsregulator.com.

2. Hammond Valve: www.hammondvalve.com.
 3. Milwaukee Valve Company: www.milwaukeevalve.com.
 4. Apollo: www.conbraco.com.
 5. Stockham: www.stockham.com.
 6. Nibco, Inc.: www.nibco.com.
 7. Substitutions: See Section 01 63 00.
- B. Size 2 inch and Under:
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.
- C. Size 1-1/2 inch to 4 inch:
1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.
- D. Size 5 inch and Larger:
1. Class 125, flanged iron body, basket pattern with 1/8 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.

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. Refer to Section 22 05 16.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.
- I. Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover.
- J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- L. Provide support for utility meters in accordance with requirements of utility companies.
- M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- N. Excavate in accordance with 31 20 00.
- O. Backfill in accordance with 31 20 00.
- P. Install bell and spigot pipe with bell end upstream.

- Q. Install valves with stems upright or horizontal, not inverted.
- R. Install water piping to ASME B31.9.
- S. Sleeve pipes passing through partitions, walls and floors.
- T. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. For pipe runs of 1 inch or less and ran high and tight to the structure, use Hubbard Enterprises/Holdrite #121 or #125 Series Brackets in conjunction with Hubbard Enterprises/Holdrite #260 or #400 Series Inserts or approved equal.
 - 6. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
- U. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9 and MSS SP-89.
 - 2. Support horizontal piping as scheduled.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical 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.
 - 8. Provide copper plated hangers and supports for copper piping or sheet lead packing between hanger or support and piping.
 - 9. Provide hangers adjacent to motor driven equipment with vibration isolation.
 - 10. Support cast iron drainage piping at every joint.
 - 11. Support of pipe tubing and equipment is to be accomplished by means of engineered products specific to each application. Makeshift field devised methods will not be allowed.

3.04 APPLICATION

- A. PVC piping allowed in locations described in Section 22 00 00.
- B. PEX piping allowed in locations as described in Section 22 00 00.
- C. Install unions downstream of valves and at equipment or apparatus connections.
- D. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install ball valves for throttling, bypass, or manual flow control services.
- F. Provide spring loaded check valves on discharge of water pumps.
- G. Provide plug valves in natural gas systems for shut-off service.
- H. Provide flow controls in water recirculating systems where indicated.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.

- B. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. 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 and storm 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 reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
 - 1. Provide 18 gage 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.

END OF SECTION

**SECTION 22 10 06
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floor drains.
- B. Cleanouts.
- C. Hydrants.
- D. Backflow preventers.
- E. Water hammer arrestors.
- F. Grease interceptor.
- G. Thermostatic mixing valves.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 22 30 00 - Plumbing Equipment.
- C. Section 22 40 00 - Plumbing Fixtures.
- D. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 DRAINS

- A. Floor Drain (FD-1):
 - 1. Manufacturers:
 - a. Sioux Chief 863.
 - 2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
 - B. Floor Sink (FS-1):
 - 1. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - b. Watts Regulator Company: www.watts.com.
 - c. Wade: www.wadedrains.com.
 - d. Zurn Industries, Inc: www.zurn.com.
 - e. Substitutions: See Section 01 63 00.
 - 2. Lacquered cast iron body with dome strainer and seepage flange.

2.02 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 2. Watts Regulator Company: www.watts.com.
 - 3. Wade: www.wadedrains.com.

4. Zurn Industries, Inc: www.zurn.com.
5. Sioux Chief Finish Line: www.siouxchief.com.
6. Substitutions: See Section 01 63 00.
- B. Cleanouts at Exterior Surfaced Areas (CO-1):
 1. Manufacturers:
 - a. Olympic VB 910.
- C. Cleanouts at Interior Finished Floor Areas (CO-2):
 1. Manufacturers:
 - a. Sioux Chief Finish Line.
- D. Cleanouts at Interior Finished Wall Areas (CO-3):
 1. Line type with round stainless steel access cover secured with machine screw.

2.03 HYDRANTS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 2. Watts Regulator Company: www.watts.com.
 3. Zurn Industries, Inc: www.zurn.com.
 4. Woodford Manufacturing Co.: www.woodfordmfg.com/Woodford
 5. Substitutions: See Section 01 63 00.
- B. Wall Hydrants:
 1. Manufacturers:
 - a. Woodford Manufacturing Co.; Model B67C: www.woodfordmfg.com/Woodford
 - b. Zurn Industries, Inc; Model Z-1320-C: www.zurn.com.
 2. ASSE 1019; freeze resistant, self-draining type with polished bronze wall plate hose thread spout, lockshield and removable key, and integral vacuum breaker.
- C. Floor Hydrants:
 1. ASSE 1019; chrome plated or polished bronze lockable recessed box, hose thread spout, lockshield and removable key, and vacuum breaker.

2.04 WASHING MACHINE BOXES AND VALVES

- A. Manufacturers:
 1. Sioux Chief Ox Box.
 2. Specialty Products: www.lspproducts.com.
 3. Substitutions: See Section 01 63 00.
- B. Description: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2 inch waste, slip in finishing cover.

2.05 REFRIGERATOR VALVE AND RECESSED BOX

- A. Manufacturers:
 1. Sioux Chief Ox Box.
 2. Specialty Products: www.lspproducts.com.
 3. Substitutions: See Section 01 63 00.
- B. Description: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.06 BACKFLOW PREVENTERS

- A. Manufacturers:
 1. Febco: www.febcoonline.com.
 2. Watts Regulator Company: www.watts.com.

3. Zurn Industries, Inc: www.zurn.com.
4. Substitutions: See Section 01 63 00.
- B. Reduced Pressure Backflow Preventers:
 1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.07 WATER HAMMER ARRESTORS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company; Model Hydrotol: www.jayrsmith.com.
 2. Zurn Industries, Inc: www.zurn.com.
 3. Precision Plumbing Products, Inc.: www.ppcinc.net.
 4. Sioux Chief: www.siouxchief.com.
 5. Substitutions: See Section 01 63 00.
- B. Water Hammer Arrestors:
 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.08 SUMPS AND INTERCEPTORS

- A. Grease Interceptors:
 1. Manufacturer:
 - a. Schier; Model GB-250.
 - b. Endura
 2. Construction:
 - a. Material: Seamless, rotationally molded polyethylene.
 - b. Rough-in: Above grade.
 - c. Accessories: Multi-weir baffle assembly, integral deep seal trap, removable integral flow control.
 - d. Field risers.
 - e. High water anchor kit.
 - f. Cover: Steel, epoxy coated, non-skid with gasket, securing handle.
 3. Unit Rating: ASME A112.14.3.
- B. Sediment Interceptors:

2.09 MIXING VALVES

- A. Thermostatic Mixing Valves:
 1. Manufacturers:
 - a. Symmons Industries, Inc.: www.symmons.com.
 - b. Powers: www.powerscontrols.com.
 - c. Leonard Valve Company: www.leonardvalve.com.
 - d. Substitutions: See Section 01 63 00.
 2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
 3. Capacity: As indicated on the Drawing Schedule.
 4. Accessories:

- a. Check valve on inlets.
 - b. Volume control shut-off valve on outlet.
 - c. Stem thermometer on outlet.
 - d. Strainer stop checks on inlets.
5. Cabinet: 16 gage enameled steel, for surface mounting with keyed lock.
- B. Pressure Balanced Mixing Valves:
1. Manufacturers:
 - a. Powers: www.powerscontrols.com.
 - b. Leonard Valve Company: www.leonardvalve.com.
 - c. Symmons Industries, Inc.: www.symmons.com.
 - d. Substitutions: See Section 01 63 00.
 2. Valve: Chrome plated cast brass body, stainless steel cylinder, integral temperature adjustment.
 3. Capacity: As indicated on the Drawing Schedule.
 4. Accessories:
 - a. Volume control shut-off valve on outlet.
 - b. Stem thermometer on outlet.
 - c. Strainer stop checks on inlets.
 - d. Cabinet: 16 gage enameled steel, for surface mounting with keyed lock.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to washing machine outlets and dishwashers.
- G. Install water hammer arrestors on cold water piping service for each flush valve fixture or bank of fixtures.

END OF SECTION

**SECTION 22 30 00
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water heaters.
- B. Pumps.
 - 1. Circulators.
 - 2. Sump Pumps.
- C. Water pressure booster system.

1.02 RELATED REQUIREMENTS

- A. Division 26: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

1.04 SUBMITTALS

- A. See Section 01 33 00 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.
- C. Shop Drawings:
 - 1. Indicate heat exchanger dimensions, size of tapings, and performance data.
 - 2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, 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: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 CERTIFICATIONS

- A. Water Heaters: NSF approved.
- B. Gas Water Heaters: Certified by CSA International to 1 or 2, as applicable, in addition to requirements specified elsewhere.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 HIGH EFFICIENCY GAS FIRED WATER HEATER

- A. Manufacturers:
 - 1. A.O. Smith Water Products Co; Model XHE "Cyclone": www.hotwater.com.
 - 2. Bradford-White; Model EF "eForce": www.bradfordwhite.com.
 - 3. Lochinvar.
 - 4. Teledyne - Lars.
- B. Type: Automatic, natural gas-fired, vertical storage.

- C. Tank: Glass lined welded steel ASME labelled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 3 inches foam, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
- D. Accessories: Provide NSF approved stand for kitchen applications and the following:
 - 1. Water Connections: Brass.
 - 2. Dip tube: Brass.
 - 3. Drain Valve.
 - 4. Anode: Magnesium.
 - 5. Temperature and Pressure Relief Valve: ASME labelled.
- E. Approval: By AGA as automatic storage water heater and for operation at 180 degrees F.
- F. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F. Automatic reset high temperature limiting thermostat factory set at 140 degrees F, gas pressure regulator, turbulent jet sealed combustion burner with direct venting with PVC or CPVC piping, electronic ignition, 100 percent safety shut-off pilot and thermocouple, automatic flue damper and draft hood.

2.02 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Manufacturers:
 - 1. Amtrol Inc: www.amtrol.com.
 - 2. ITT Bell & Gossett: www.bellgossett.com.
 - 3. Taco, Inc: www.taco-hvac.com.
 - 4. Substitutions: See Section 01 63 00.
- B. Construction: Welded steel; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.

2.03 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
 - 1. Armstrong Pumps Inc: www.armstrongpumps.com.
 - 2. ITT Bell & Gossett: www.bellgossett.com.
 - 3. Taco, Inc.: www.taco-hvac.com.
 - 4. Substitutions: See Section 01 63 00.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.
- G. Performance:
 - 1. As indicated on the Drawings.
 - 2. Electrical Characteristics:
 - a. Refer to Division 26.

2.04 PRESSURE BOOSTER SYSTEMS

- A. Manufacturers:
 - 1. Armstrong Pumps Inc; Model 6000 Hydropak: www.armstrongpumps.com.
 - 2. ITT Bell & Gossett; Model Series 70: www.bellgossett.com.
 - 3. Amtrol, Inc.: www.amtrol.com.
 - 4. Thrush Co., Inc.: www.thrushco.com.
 - 5. Substitutions: See Section 01 63 00.

- B. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and galvanized piping, with control panel assembled on fabricated steel base with structural steel framework.
- C. Controls and Instruments: Locate in NEMA 250 Type 1 general purpose enclosure with main disconnect interlocked with door, fused circuit for each motor, magnetic starters with three overloads, control circuit transformer with fuse protection, selector switch for each pump, low limit pressure switch, low pressure alarm light, running lights, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gauges.
- D. Lead Pump: Operate continuously with lag pump operating on system demand. Should lead pump fail to operate, next pump in sequence shall start automatically.
- E. Time Delay Relay: Prevent lag pump short cycling on fluctuating demands.
- F. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.
- G. Low Pressure Control: Stop pump operation if incoming water pressure drops to atmospheric.
- H. Pump Switch: Permit manual or automatic operation.
- I. Valving: Each pump outlet combination pressure reducing and check valve to maintain constant system pressure. Provide gate or butterfly valves on suction and discharge of each pump. Provide check valve on each pump discharge.
- J. Time Clock for Automatic Day-Night Changeover:
 - 1. Day cycle: System shall operate continuously with pressure to fixtures maintained by pressure reducing valves.
 - 2. Night Cycle: Pump shall operate intermittently on pressure switch located near pressure tank operating pump for pre-determined adjustable time period.

2.05 SUBMERSIBLE SUMP PUMPS

- A. Manufacturers:
 - 1. Armstrong Pumps Inc: www.armstrongpumps.com.
 - 2. Goulds Pumps: www.goulds.com.
 - 3. Zoeller Pump Company: www.zoeller.com.
 - 4. Substitutions: See Section 01 63 00.
- B. Type: Completely submersible, vertical, centrifugal.
- C. Casing: Cast iron pump body and oil filled motor chamber.
- D. Impeller: Cast iron; open non-clog, stainless steel shaft.
- E. Bearings: Ball bearings.
- F. Sump: Fiberglass basin with steel cover plate.
- G. Accessories: Oil resistant 6 foot cord and plug with three-prong connector for connection to electric wiring system including grounding connector.
- H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.
- I. Controls: Integral diaphragm type level controls with separate liquid level control high level alarm.

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, gas venting, and electrical work to achieve operating system.
- C. Pumps:

1. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.
2. Provide air cock and drain connection on horizontal pump casings.
3. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
4. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
5. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

**SECTION 22 40 00
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water closets (minimum MaP rating at 1.28 gpm).
- B. Lavatories.
- C. Sinks.
- D. Service sinks.
- E. Electric water coolers.
- F. Drinking fountains.
- G. Bathtubs.
- H. Showers.

1.02 RELATED REQUIREMENTS

- A. Section 06 41 00 - Architectural Wood Casework: Preparation of counters for sinks; lavatory tops.
- B. Section 07 90 05 - Joint Sealers: Seal fixtures to walls and floors.
- C. Section 22 10 05 - Plumbing Piping.
- D. Section 22 10 06 - Plumbing Piping Specialties.
- E. Section 22 30 00 - Plumbing Equipment.
- F. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- B. ANSI Z124.1.2 - American National Standard for Plastic Bathtub and Shower Units; 2005.
- C. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2009.
- D. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008.
- E. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).
- F. ASME A112.18.1 - Plumbing Supply Fittings; 2012.
- G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); 2008 (R2013).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- F. Waterless Urinals: Submit recommended frequency of maintenance and parts replacement, methods of cleaning, sources of replacement supplies and parts.

1.05 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.
- C. Extra Materials / Attic Stock:

1. For every 100 apartment units provide:
 - a. Two (2) lavatory faucets.
 - b. Two (2) shower mixing valves.
 - c. Two (2) shower heads.
 - d. Two (2) sink faucets.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of this section with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 PRE-INSTALLATION MEETINGS

- A. Section 01 33 00 - Submittal Procedures: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 63 00 - Product Substitution Procedure Requirements: Product storage and handling requirements.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.10 WARRANTY

- A. Section 01 77 00 - Closeout Procedures: Product warranties and product bonds.

1.11 EXTRA STOCK

- A. For Apartment units, provide 1 spare faucet of each type for every 100 dwelling units. Minimum of 1 each. Include control /mixing valve when applicable.
- B. For apartment units, provide 1 spare shower head of each type for every 100 units. Minimum of 1 each.

PART 2 PRODUCTS

2.01 SEE BID REQUEST FOR PROPOSAL EXHIBIT 4 FOR BASELINE FIXTURE PACKAGE

2.02 LAVATORY INSULATION KIT

- A. Manufacturers:
 1. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white or gray color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01 33 00 - Submittal Procedures: Coordination and project conditions.
- B. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- C. Verify that electric power is available and of the correct characteristics.

- D. 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 work in accordance with all applicable codes.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 90 05, color to match fixture.
- G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
- H. For ADA accessible water closets, install flush valve with handle to wide side of stall.

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. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

3.07 SCHEDULES

- A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
 - 1. Water Closet:
 - a. Standard: 15 inches to top of bowl rim.
 - b. Accessible: 18 inches to top of seat.
 - 2. Water Closet Flush Valves:
 - a. Standard: 11 inches min. above bowl rim.
 - b. Recessed: 10 inches min. above bowl rim.
 - 3. Urinal:
 - a. Standard: 22 inches to top of bowl rim.
 - b. Accessible: 17 inches to top of bowl rim.
 - 4. Lavatory:
 - a. Standard: 31 inches to top of basin rim.
 - b. Accessible: 34 inches to top of basin rim.
 - 5. Drinking Fountain:
 - a. Child: 30 inches to top of basin rim.
 - b. Standard Adult: 40 inches to top of basin rim.

- c. Accessible: 36 inches to top of spout.
- 6. Shower Heads:
 - a. Adult Male: 69.5 inches to bottom of head.
 - b. Adult Female: 64.5 inches to bottom of head.
 - c. Child: 58.5 inches to bottom of head.

3.08 FIXTURE FLOW RATES

- A. Shower Heads: 1.5 gpm.
- B. Public Lavatory: 0.5 gpm.
- C. Residential Lavatory: 1.0 gpm.
- D. Kitchen Faucet: 1.5 gpm.
- E. Toilets: 1.28 gpf.

END OF SECTION

**SECTION 23 00 00
BASIC HVAC REQUIREMENTS**

PART 1 GENERAL

1.01 PROJECT DESCRIPTION

- A. It is expected that each of the individual Design-Build subcontractors will evaluate this information, provide additional recommendations/input, and be responsible for the final design throughout the design-build process.

1.02 REQUIREMENTS

- A. Building Envelope Design Criteria: (Confirm all values with Architect)
- B. Design Drawings:
 - 1. Base Drawings: Architect will furnish electronic copies of floor, ceiling, and roof plans for background of mechanical design drawings.
 - 2. Design Drawings: Develop HVAC design drawings prior to starting work. Coordinate with architectural ceiling layout drawings.
- C. Performance Requirements:
 - 1. Code Requirements: Comply with requirements of State and Local regulatory agencies.
 - 2. Permit, Plan Check, and Inspection Fees: Arrange and pay fees for HVAC permit, and plan check, by regulatory agencies and utilities for work in this Division.
 - 3. Ventilation and Exhaust: Comply with requirements of 2019 Oregon Mechanical Specialty Code Chapter 4 and 5.
 - 4. Building Pressurization: Design shall provide for an approximate balance between exhaust and make-up/ventilation air volumes so that a relatively neutral building pressure is maintained.
 - 5. Room-by-Room load calculations. Calculate heat loss and heat gains on a room-by-room basis in accordance with ASHRAE standard 183 and ASHRAE Handbook or Fundamentals.
 - 6. Detailed ventilation schedule and calculations.
- D. Product Submittals:
 - 1. Submit electronic copies of product data for mechanical equipment, including but not limited to valves, fittings, fans, controls, filters, and similar system components.
 - 2. Indicate the exact item to be furnished and reference to Section, Article, and Paragraph where the item is specified.
- E. Quality Assurance Submittals:
 - 1. Submit electronic copies of HVAC design drawings.
 - 2. Submit electronic copies of shop drawings fully coordinated with all Electrical, Plumbing, and Fire components.
 - a. Content and View: Two views, concealed conditions and visually exposed conditions, shown as reflected plans. Indicate actual size of components at scale sufficient to show no interference and adequate space for installation and maintenance of each component.
 - b. Overlay drawings by mechanical showing all Electrical, Plumbing, and Fire systems. Coordinate until all conflicts are resolved. Provide single point of overlaying.
- F. Project Record Documents: Comply with requirements of Section 01 33 00 - Submittal Procedures and Section 01 70 00 - Execution and Closeout Requirements.
- G. Operation and Maintenance Data: Comply with Section 01 78 00 - Closeout Procedures.

- H. Manufacturer's Warranty: Submit two signed copies of manufacturer's standard limited warranty for each item where a warranty is specified in this Division.
- I. Installer's Warranty:
 - 1. Furnish two copies of installer's limited warranty against defects in labor for a period of one year from the date of Substantial Completion.
 - 2. Installer shall correct defects in Mechanical systems and equipment which occur within the one year warranty period.
- J. Maintenance Service: Maintain equipment and systems in operating condition until Substantial Completion. Furnish spare parts for items requiring replacement within one year.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.04 HVAC SYSTEM DESIGN CRITERIA:

- A. Corridors and Common Areas Pressurization:
 - 1. Provide gas heat and cooling: Minimum 0.15 CFM/SF for the corridors.
 - 2. Provide corridor RTU with spring isolation curb.
 - 3. Maintain relatively neutral building pressurization.
 - 4. Grilles, registers and diffusers, Max NC-25.
 - 5. Filters: 2 inch, MERV 8.
 - 6. Ductwork and associated insulation, backdraft/motorized dampers, volume dampers, access panels, and controls. Ductwork supply air distribution down corridors.
 - 7. Air balancing with reports.
- B. Elevator Equipment Room:
 - 1. Provide room temperature control to the satisfaction of the elevator inspector.
 - 2. Provide ductless wall mounted "mini-split".
- C. Apartment Units:
 - 1. Living Units: PTHP, manufacturer's oversized architectural louver.
 - 2. Bedroom Heating: Electric heater with remote thermostat. Sized by Mechanical and provided by Electrical.
 - 3. Ventilation: An in-unit Energy Recovery Ventilator (ERV) will provide ducted supply and exhaust from each unit. One central supply will provide fresh air to the unit. The ERV will continuously exhaust the bathrooms and kitchen area. ERV outside air and exhaust ducts will terminate horizontally to building exterior.
 - 4. Dryers are ventless condensing or heat pump type..
 - 5. Kitchens are to be exhausted with continuous kitchen area vent through the ERV. Range hoods will be circulating type, by architect.
 - 6. ERV, bath, dryer, and range fans to vent horizontal to exterior wall terminations.
- D. Lobby/Amenity Areas:
 - 1. Provide cooling and heating sufficient to compensate for typical tenant traffic.
 - 2. Locate concealed ducted fan coil above the ceiling. Hang unit with neoprene isolation pads. Fan coils to be inverter type without electric heat.
 - 3. Split system heat pump unit with neoprene isolation pads on concrete pads.
 - 4. Split system to have filter box with MERV 8 air filters.
 - 5. Provide exhaust for restrooms.
 - 6. Grilles, registers and diffusers, MAX NC-25.
 - 7. Wall louver with baked enamel finish for OSA intake and general exhaust.
 - 8. Programmable thermostat with locking cover or lockout feature.

9. Ductwork and associated insulation, motorized dampers, volume dampers, access panels, and controls.
10. Air balance with reports.
- E. Domestic Water Room and Water Heater Rooms:
 1. Electric unit heaters for freeze protection (by Electrical).
 2. Provide continuous exhaust.
 3. Route water heater flues and intakes horizontal from level 1.
- F. Stairs (with exterior walls):
 1. Provide electric wall heat. Locate at the bottom of each stairwell (by Electrical).
- G. Server/AV Room, DAS Room, and Inverter Room:
 1. Provide ductless wall mounted “mini split”.
- H. Janitor Room:
 1. Provide continuous exhaust; 12 ACH.
- I. Trash Collection Room:
 1. Provide continuous exhaust; 12 ACH. Route exhaust sidewall
 2. Provide electric wall heaters for freeze protection (by electrical).
- J. Trash Chute Room:
 1. Provide continuous exhaust, 8-12 ACH.
 2. Provide electric wall heaters for freeze protection (by Electrical).
- K. Bike Room:
 1. Provide continuous exhaust for ventilation.
 2. Provide heating with electric unit heaters.
- L. Clubhouse Building:
 1. Provide cooling and heating.
 2. Locate concealed ducted fan coil above the ceiling. Hang unit with neoprene isolation pads. Fan coils to be inverter type without electric heat.
 3. Split system heat pump unit with neoprene isolation pads on concrete pad.
 4. Split system to have filter box with MERV 8 air filters.
 5. Provide exhaust for restrooms.
 6. Grilles, registers and diffusers, MAX NC-25.
 7. Wall louver with baked enamel finish for OSA intake and general exhaust.
 8. Programmable thermostat with locking cover or lockout feature.
 9. Ductwork and associated insulation, motorized dampers, volume dampers, access panels, and controls.
 10. Air balance with reports.
- M. Retail Building:
 1. Provide electric heating for freeze protection.

END OF SECTION

**SECTION 23 05 49
HVAC SEISMIC RESTRAINT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Seismic restraint of equipment, piping and ductwork.

1.02 RELATED SECTIONS

- A. Section 23 00 00 - Basic HVAC Requirements.
- B. Section 23 31 00 - HVAC Ducts and Casings.
- C. Section 23 74 13 - Packaged Outdoor Central-Station Rooftop Units.
- D. Section 23 81 27 - Split-System Heating and Cooling.

1.03 QUALITY ASSURANCE

- A. Seismic Restraints:
 - 1. The Anchorage and/or seismic restraint of permanent equipment and associated systems listed below shall be designed to resist the total design seismic forces prescribed in the latest edition of the International Building Code.
 - a. All floor or roof-mounted equipment weighing 400 lbs. or greater.
 - b. All suspended or wall-mounted equipment weighing 20 lbs. or greater.
 - c. All vibration-isolated equipment weighing 20 lbs. or greater.
 - d. All piping 1 1/4 inches nominal diameter and larger located in boiler, mechanical equipment and refrigeration mechanical rooms.
 - e. All piping 2 1/2" inches nominal diameter and larger.
 - f. All ductwork 6 square feet and larger in cross sectional area.
 - g. All round ductwork 28 inches in diameter and larger.
 - h. Pipes, electrical conduit and ducts supported by a trapeze where none of those elements would individually require bracing, require bracing when the combined operating weight of all elements supported by the trapeze is 10 lbs/ft or greater.
 - B. All calculations shall be in accordance with Chapter 16 of the latest edition of the International Building Code.

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00:
 - 1. All anchorage and seismic restraints shall be designed and stamped by a professional engineer licensed in the state of the project location. Design shall include:
 - a. Number, size and location of anchors for floor or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. In addition, provide calculations or test data verifying the curb can accept the seismic loads.
 - b. Number, size and location of seismic restraint devices and anchors for vibration-isolated and suspended equipment. Provide calculations or test data verifying the horizontal and vertical ratings of the seismic restraint devices.
 - c. Number, size and location of braces and anchors for suspended piping and ductwork on shop drawings. In addition:
 - 1) The contractor must select a single seismic restraint system pre-designed to meet the requirements of the latest edition of the International Building Code such as the 1999 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork and Electrical Systems.

- 2) Details or designs from separate seismic restraint guidelines are not acceptable. Installations not addressed by the selected system must be designed, detailed and submitted along with the shop drawings.
- 3) Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional engineer licensed in the state of the project location who designed the layout of the braces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Amber Booth.
- B. Mason Industries, Inc.
- C. Kinetics Corporation.
- D. Vibrex.
- E. Substitutions: Under provisions of Section 01 63 00.

2.02 SEISMIC RESTRAINTS

- A. General Requirements:
 1. Seismic restraints shall be provided for all equipment, both supported and suspended, piping and ductwork as listed above.
 2. Bracing of piping and ductwork shall be in accordance with provisions set forth in SMACNA seismic restraint manual.
 3. Structural requirements for restraints, including their attachment to building structure, shall be reviewed and approved by the structural engineer.
 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.
- B. Supported Equipment Products:
 1. Seismic restraints shall consist of interlocking steel members restrained by shock absorbent neoprene materials compounded to bridge bearing specifications as previously noted in paragraph 1.3. Elastomeric materials shall be replaceable and be a minimum 3/4-inch thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8-inch, nor more than 1/4-inch. Type 1 - Seismic Snubbers: All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 inch thick. A minimum air gap of 1/8 inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. The snubber shall be designed to accept horizontal and vertical seismic loads as defined in Section 1.03.B. Mason Type Z-1225 or Z-1011.
 2. Each snubber shall be capable of restraint in all three mutually orthogonal directions. Type 2 - Seismic Sway Braces - Seismic sway braces shall consist of galvanized steel aircraft cables or steel angles/channels. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel to the final installation angle. Do not mix cable and steel braces to brace the same system or equipment. Steel angles, when required, shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps. Sway braces shall be designed to accept horizontal

and vertical seismic loads as defined in Section 1.03.B. Mason Type SCB, SSB, SRC and UC.

3. Submittals shall include load versus deflection curves up to 1/2-inch on the x, y and z planes.
 4. Mason Model Z-1011
- C. Bracing of Pipes:
1. Provide seismic bracing of all piping as detailed below. (Exception: Piping suspended by individual hangers 12 inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced).
 - a. Brace all gas piping.
 - b. Brace all piping located in boiler rooms, mechanical equipment rooms, and refrigeration mechanical rooms that is 1-1/4-inch nominal diameter and larger.
 - c. Brace all pipes 2-1/2-inch nominal diameter and larger.
 2. For all gas piping, as specified in 1(a) the bracing details, schedules, and notes may be used, except that transverse bracing shall be at 20 feet maximum, and longitudinal bracing shall be at 40 feet maximum.
 3. Seismic braces for pipes on trapeze hangers may be used.
 4. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, the flexibility may be provided by the installation of swing joints.
 5. Cast iron pipe of all types, glass pipe, and any other pipe jointed with a shield and clamp assembly, where the top of the pipe is 12 inches or more from the supporting structure, shall be braced on each side of a change in direction of 90 degrees or more. Riser joints shall be braced or stabilized between floors.
 6. Vertical risers shall be laterally supported with a riser clamp at each floor. For buildings greater than six stories high, all risers shall be engineered individually.
- D. Bracing of Ductwork:
1. Brace rectangular ducts with cross sectional areas of 6 square feet and larger. Brace flat oval ducts in the same manner as rectangular ducts. Brace round ducts with diameters of 28 inches and larger. Brace flat oval ducts the same as rectangular ducts of the same nominal size (Exception: No bracing is required if the duct is suspended by hangers 12 inches or less in length, as measured from the top of the duct to the bottom of the support where the hanger is attached).
 2. Transverse bracing shall occur at the interval specified in the SMACNA tables or at both ends if the duct run is less than the specified interval. Transverse bracing shall be installed at each duct turn and at each end of a duct run, with a minimum of one brace at each end.
 3. Longitudinal bracing shall occur at the interval specified in the SMACNA tables with at least one brace per duct run. Transverse bracing for one duct section may also act as longitudinal bracing for a duct section connected perpendicular to it if the bracing is installed within four feet of the intersection of the ducts and if the bracing is sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
- E. Suspended Equipment and Piping and Ductwork:
1. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable and the specified vibration isolation hanger with an added nut and neoprene and steel washer. The cable resists lateral and downward motion. The modified vibration hanger resists upward motion.

2. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and are to be indicated in the Shop Drawings.
3. Provide detailed Shop Drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

PART 3 EXECUTION

3.01 SEISMIC RESTRAINTS

- A. General:
 1. Install and adjust seismic restraints so that the equipment, piping, and ductwork supports are not degraded by the restraints.
 2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- B. Supported Equipment:
 1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
 2. Care must be taken so that a minimum 1/8-inch air gap in the seismic restraint snubber is preserved on all sides in order that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.
- C. Bracing of Pipes:
 1. Branch lines may not be used to brace main lines.
 2. Transverse bracing shall be at 40 feet maximum except where a lesser spacing is indicated in the SMACNA tables for bracing of pipes.
 3. Longitudinal bracing shall be at 80 feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity equal to or greater than a longitudinal brace. The longitudinal braces and connections must be capable of resisting the additional force induced by expansion and contraction.
 4. A rigid piping system shall not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.
 5. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24 inches of the elbow or tee.
- D. Bracing of Ductwork:
 1. Hangers must be positively attached to the duct within 2 inches of the top of the duct with a minimum of two #10 sheet metal screws.
 2. Group of ducts may be combined in larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
 3. Walls, including gypsum board nonbearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide solid blocking around duct penetrations at stud wall construction.
 4. Unbraced ducts shall be installed with a 6-inch minimum clearance to vertical ceiling hanger wires.
- E. Suspended Equipment, Piping, and Ductwork Cable Method:
 1. Cables shall be adjusted to a degree of slackness approved by the Structural Engineer.

2. Uplift and downward restraint nuts and washers for the Type HST hangers shall be adjusted so that there is a minimum 1/4-inch clearance.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

1.02 RELATED REQUIREMENTS

- A. Section 01 35 15.13 - LEED for Homes Requirements - See this section for contract requirements and procedural responsibilities.
- B. Section 23 00 00 - Basic HVAC Requirements.

1.03 REFERENCE STANDARDS

- A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

1.04 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. See Section 01 35 15.13 - LEED Submittal requirements.
- C. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- D. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Submit to the Commissioning Authority, Construction Manager, and HVAC controls contractor.
 - 3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
 - 5. Include at least the following in the plan:
 - a. Preface: An explanation of the intended use of the control system.
 - b. List of all air flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - d. Identification and types of measurement instruments to be used and their most recent calibration date.
 - e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - f. Final test report forms to be used.
 - g. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.

- 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - h. Expected problems and solutions, etc.
 - i. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
 - j. Description of TAB work for areas to be built out later, if any.
 - k. Time schedule for deferred or seasonal TAB work, if specified.
 - l. False loading of systems to complete TAB work, if specified.
- E. Field Logs: Submit at least once a week to Commissioning Authority and Construction Manager.
- F. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- G. Progress Reports.
- H. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit to the Commissioning Authority, Construction Manager, and HVAC controls contractor within two weeks after completion of testing, adjusting, and balancing.
 2. Revise TAB plan to reflect actual procedures and submit as part of final report.
 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 4. Provide reports in 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 7. Units of Measure: Report data in I-P (inch-pound) units only.
 8. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Project altitude.
 - j. Report date.
- I. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC MN-1, AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience, and certified by AABC.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
- F. Pre-Qualified TAB Agencies:
 - 1. Air Test and Balance.
 - 2. Neudorfer Engineering.
 - 3. Substitutions: See Section 01 63 00.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Access doors are closed and duct end caps are in place.
 - 9. Air outlets are installed and connected.
 - 10. Duct system leakage is minimized.
- B. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 - 1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 - 1. Running log of events and issues.
 - 2. Discrepancies, deficient or uncompleted work by others.
 - 3. Contract interpretation requests.
 - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.

3.06 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Measure air quantities at air inlets and outlets.
- C. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

3.07 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Plumbing Pumps
 - 2. Packaged Roof Top Heating/Cooling Units
 - 3. Fans
 - 4. Air Inlets and Outlets

3.08 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer
 - 2. Model/Frame
 - 3. HP/BHP
 - 4. Phase, voltage, amperage; nameplate, actual, no load
 - 5. RPM
 - 6. Service factor
 - 7. Starter size, rating, heater elements
 - 8. Sheave Make/Size/Bore
- B. Air Cooled Condensers:
 - 1. Identification/number
 - 2. Location
 - 3. Manufacturer
 - 4. Model number
 - 5. Serial number
 - 6. Entering DB air temperature, design and actual

7. Leaving DB air temperature, design and actual
8. Number of compressors
- C. Electric Duct Heaters:
 1. Manufacturer
 2. Identification/number
 3. Location
 4. Model number
 5. Design kW
 6. Number of stages
 7. Phase, voltage, amperage
 8. Test voltage (each phase)
 9. Test amperage (each phase)
 10. Air flow, specified and actual
 11. Temperature rise, specified and actual
- D. Return Air/Outside Air:
 1. Identification/location
 2. Design air flow
 3. Actual air flow
 4. Design return air flow
 5. Actual return air flow
 6. Design outside air flow
 7. Actual outside air flow
 8. Return air temperature
 9. Outside air temperature
 10. Required mixed air temperature
 11. Actual mixed air temperature
 12. Design outside/return air ratio
 13. Actual outside/return air ratio
- E. Exhaust Fans:
 1. Location
 2. Manufacturer
 3. Model number
 4. Serial number
 5. Air flow, specified and actual
- F. Air Distribution Tests:
 1. Air terminal number
 2. Room number/location
 3. Terminal type
 4. Terminal size
 5. Area factor
 6. Design velocity
 7. Design air flow
 8. Test (final) velocity
 9. Test (final) air flow

REMBOLD ELMONICA APARTMENTS
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10. Percent of design air flow

END OF SECTION

**SECTION 23 07 13
DUCT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct Liner.

1.02 REFERENCE STANDARDS

- A. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.
- B. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.
- C. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2008.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.03 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 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.

1.05 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 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Knauf Insulation; Model "Duct Wrap": www.knaufusa.com.
 - 2. Johns Manville Corporation; Model "Microlite": www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation: www.certainteed.com.
 - 5. Substitutions: See Section 01 63 00.

- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 450 degrees F.
 - 3. Maximum Water Vapor Sorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Outdoor Vapor Barrier Mastic:
 - 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- F. Tie Wire: Annealed steel, 16 gage.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. Knauf Insulation; Model "Rigid Plenum Liner": www.knaufusa.com.
 - 2. Johns Manville Corporation; Model "Permacote Linacoustic R-300": www.jm.com/#sle.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation; Model "ToughGard® Rigid Liner Board": www.certainteed.com.
 - 5. Substitutions: See Section 01 63 00.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. 'K' value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum service temperature: 450 degrees F.
 - 3. Maximum Water Vapor Sorption: 5.0 percent.
 - 4. Maximum Density: 8.0 lb/cu ft.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 DUCT LINER

- A. Manufacturers:
 - 1. Knauf Insulation; Model "Duct Liner E-M": www.knaufusa.com.
 - 2. Johns Manville Corporation; Model "Permacote Linacoustic" or "Spiracoustic": www.jm.com/#sle.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation; Model "ToughGard® Duct Liner": www.certainteed.com.
 - 5. Substitutions: See Section 01 63 00.

- B. Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C 1071; impregnated surface and edges coated with acrylic polymer.
 - 1. Fungi Resistance: ASTM G 21.
 - 2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
 - 3. Service Temperature: Up to 250 degrees F.
 - 4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
 - 5. Minimum Noise Reduction Coefficients:
 - a. 1/2 inch Thickness: 0.30.
 - b. 1 inch Thickness: 0.45.
 - c. 1-1/2 inches Thickness: 0.60.
 - d. 2 inch Thickness: 0.70.
- C. Liner Fasteners: Galvanized steel, welded with press-on head.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ducts have been tested before 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. 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.
- F. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 100 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.
 - 4. Seal liner surface penetrations with adhesive.
 - 5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

- A. Exhaust Ducts Within 10 ft of Exterior Openings:
 - 1. Flexible Glass Fiber Duct Insulation: Minimum 2 inches thick or R-Value of 8.
- B. Outside Air Intake Ducts:
 - 1. Flexible Glass Fiber Duct Insulation: Minimum 2 inches thick or R-Value of 8.
- C. Supply Ducts:
 - 1. Flexible Glass Fiber Duct Insulation: Minimum 1 inches thick or R-Value of 6.
- D. Ducts Exposed to Outdoors:
 - 1. Flexible or Rigid Glass Fiber Duct Insulation: Minimum 2 inches thick or R-Value of 8.

END OF SECTION

**SECTION 23 31 00
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 49 - HVAC Seismic Restraint.
- B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- C. Section 23 07 13 - Duct Insulation: External insulation and duct liner.
- D. Section 23 37 00 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.04 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Product Data: Provide data for duct materials, duct liner, duct connections, and duct fittings.
- C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.06 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 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 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. VOC Content: Not more than 250 g/L, excluding water.
 - 3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.
 - 4. For Use With Flexible Ducts: UL labeled.
 - 5. Acceptable Products:
 - a. Duro-Dyne; Model DSW: www.durodyne.com.
 - b. Hard Cast; Model RTA 50: www.hardcast.com.
 - c. Hard Cast; Model "Versa-Grip" 102: www.hardcast.com.

- d. Sika; Model "Sikaflex": www.sika.com.
- e. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
- E. All Ducts: Galvanized steel, unless otherwise indicated.
- F. Low Pressure Supply (Heating Systems): 1 inch w.g. pressure class, galvanized steel.
- G. Low Pressure Supply (System with Cooling Coils): 1 inch w.g. pressure class, galvanized steel.
- H. Return and Relief: 1/2 inch w.g. pressure class, galvanized steel.
- I. General Exhaust: 1/2 inch w.g. pressure class, galvanized steel.
- J. Outside Air Intake: 1/2 inch w.g. pressure class, galvanized steel.

2.02 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- C. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- F. 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.

2.03 DUCT MANUFACTURERS

- A. Streimer Sheet Metal: www.streimer.com.
- B. General Sheet Metal Works.
- C. Rolok Products: www.rolok.com.
- D. Arctic Sheet Metal: www.arcticsheetmetal.com.
- E. Arjae Sheet Metal: www.arjae.com.
- F. Robert Lloyd Sheet Metal: www.rlsn.net.
- G. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Use sealant on all lapped round duct joint connections.
- E. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

- F. Install duct hangers and supports in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- G. Connect terminal units to supply ducts with one foot maximum length of flexible duct. Do not use flexible duct to change direction.
- H. At exterior wall louvers, seal duct to louver frame .

END OF SECTION

**SECTION 23 33 00
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Combination fire and smoke dampers.
- B. Duct access doors.
- C. Fire dampers.
- D. Flexible duct connections.
- E. Volume control dampers.

1.02 RELATED REQUIREMENTS

- A. Division 26 00 00 - Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- B. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
- C. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.
- D. Project Record Drawings: Record actual locations of access doors, test holes, fire dampers, and fire and smoke dampers.

1.05 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
 - 1. PCI Industries, Inc; Pottorff Brand Model Series FSD: www.pottorff.com.
 - 2. Cesco; Model Series CG: www.cescoproducts.com.
 - 3. Greenheck; Model FSD-211: www.greenheck.com.
 - 4. Ruskin; Model FSD60: www.ruskin.com.
 - 5. Substitutions: See Section 01 63 00.
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- C. Provide factory sleeve and collar for each damper.
- D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

- E. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.
- F. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.
- G. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.02 DUCT ACCESS DOORS

- A. Manufacturers:
 - 1. Cesco; Model Series HF: www.cescoproducts.com.
 - 2. Greenheck; Model Series HAD/CAD: www.greenheck.com.
 - 3. Ruskin; Model series ADH/HARDD: www.ruskin.com.
 - 4. Substitutions: See Section 01 63 00.
- B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
 - 1. Less Than 12 inches Square: Secure with sash locks.
 - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
- C. Access doors with sheet metal screw fasteners are not acceptable.

2.03 FIRE DAMPERS

- A. Manufacturers:
 - 1. PCI Industries, Inc; Pottorff Brand : www.pottorff.com.
 - 2. Cesco: www.cescoproducts.com.
 - 3. Greenheck: www.greenheck.com.
 - 4. Ruskin: www.ruskin.com.
 - 5. Substitutions: See Section 01 63 00.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
- D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- F. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.04 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers:

1. Elgen Manufacturing: www.elgenmfg.com.
2. Substitutions: See Section 01 63 00.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.
 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
 - a. Net Fabric Width: Approximately 3 inches wide.
 2. Metal: 3 inches wide, 24 gage thick galvanized steel.
- D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
- E. Maximum Installed Length: 14 inch.

2.05 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 1. Cesco; Model Series MGF/MGG: www.cescoproducts.com.
 2. Greenheck; Model Series MBD/MBDR: www.greenheck.com.
 3. Substitutions: See Section 01 63 00.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
 1. Fabricate for duct sizes up to 6 x 30 inch.
 2. Blade: 24 gage, minimum.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 1. Blade: 18 gage, minimum.
 2. Product: MD35 manufactured by Ruskin.
- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
 1. Product: 515A manufactured by Young Regulator.
- F. Quadrants:
 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as

indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

- D. Provide fire dampers and combination fire/smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Install combination smoke/fire dampers in accordance with NFPA 92A.
- F. Demonstrate re-setting of fire dampers to Owner's representative.
- 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 2 duct widths from duct take-off.
- J. Provide balancing dampers on high velocity systems where indicated.
- K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified or shown as part of the diffuser, grille, or register assembly.
- L. Provide remote-operated volume damper where dampers are inaccessible above hard lid ceilings.

END OF SECTION

**SECTION 23 34 23
HVAC POWER VENTILATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof exhausters.
- B. Ceiling exhaust fans.
- C. Dryer booster fan.

1.02 RELATED REQUIREMENTS

- A. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.
- B. Section 26 00 00 - Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AMCA 99 - Standards Handbook; 2010.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

1.04 SUBMITTALS

- A. See Section 01 33 00 - for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.

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 POWER VENTILATORS - GENERAL

- A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
- C. Fabrication: Conform to AMCA 99.
- D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 ROOF EXHAUSTERS

- A. Manufacturers:
 - 1. Greenheck; Model G or GB: www.greenheck.com.
 - 2. Carnes; Model Series VE: www.carnes.com.
 - 3. Loren Cook Company; Model Series AC: www.lorencook.com.
 - 4. JenCoFan; Model RED or DB: www.jencofan.com.
 - 5. PennBarry; Model Domex: www.pennbarry.com.
 - 6. Substitutions: See Section 01 63 00.

- B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- C. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, interior baffle with acoustic insulation, curb bottom, and factory installed nailer strip.
- D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.
- E. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.
- F. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.03 CEILING EXHAUST FANS (RESIDENTIAL)

- A. Manufacturers:
 - 1. Panasonic; Model FV-05-11VKS1.
 - 2. Broan.
 - 3. Greenheck: www.greenheck.com.
- B. Construction:
 - 1. Centrifugal Fan Unit: 2 speed or direct driven with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
 - 2. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
 - 3. Grille: White Plastic.
 - 4. Coordinate with electrical for motion detector increase to high speed.

2.04 CEILING EXHAUST FANS (OTHER THAN RESIDENTIAL)

- A. Manufacturers:
 - 1. Broan.
 - 2. Greenheck; Model Series SP/CSP: www.greenheck.com.
 - 3. Carnes; Model Series VCDD: www.carnes.com.
 - 4. Loren Cook Company; Model Series GC/GN: www.lorencook.com.
 - 5. JenCoFan; Model Series FF/FFC: www.jencofan.com.
 - 6. PennBarry; Model Zephyr: www.pennbarry.com.
 - 7. Substitutions: See Section 01 63 00.
- B. Construction:
 - 1. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
 - 2. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
 - 3. Grille: Aluminum with baked white enamel finish.
 - 4. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- C. Performance:
 - 1. As indicated on the Drawing Schedule.

- D. Electrical Characteristics and Components:
 - 1. Electrical Characteristics: In accordance with Division 26.
 - 2. Controls: As scheduled.
 - 3. Disconnect Switch: Factory mount disconnect switch on equipment.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with stainless steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Hung Cabinet Fans:
 - 1. Install fans with resilient mountings and flexible electrical leads.
 - 2. Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Provide sheaves required for final air balance.
- F. Install backdraft dampers on inlet to roof and wall exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

**SECTION 23 37 00
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers.
 - 1. Perforated ceiling diffusers.
- B. Rectangular ceiling diffusers.
- C. Registers/grilles.
 - 1. Wall-mounted, supply register/grilles.
 - 2. Wall-mounted, exhaust and return register/grilles.
- D. Louvers.
- E. Roof hoods.

1.02 RELATED REQUIREMENTS

- A. Section 09 90 00 - Painting and Coating: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. See Section 01 33 00 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carnes Company HVAC: www.carnes.com.
- B. Krueger: www.krueger-hvac.com.
- C. Price Industries: www.price-hvac.com.
- D. Titus: www.titus-hvac.com.
- E. MetalAire: www.metalaire.com.
- F. Substitutions: See Section 01 63 00.

2.02 RECTANGULAR CEILING DIFFUSERS

- A. Manufacturers:
 - 1. Carnes Model Series SK.
 - 2. Price Model SMD.
 - 3. Krueger Model SHPC.
 - 4. Titus Model TDC.
 - 5. Substitutions: See Section 01 63 00.
- B. Type: Square and rectangular, multi-louvered diffuser to discharge air in indicated pattern .
- C. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.
- D. Fabrication: Steel with baked enamel off-white finish.
- E. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.03 PERFORATED FACE CEILING DIFFUSERS

- A. Manufacturers:
 - 1. Carnes Model Series SPMB.
 - 2. Price Model PDMC.

3. Krueger Model 1240P.
 4. Titus Model PMC.
 5. Substitutions: See Section 01 63 00.
- B. Type: Perforated face with modular core and removable face.
 - C. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.
 - D. Fabrication: Steel with steel frame and baked enamel off-white finish.
 - E. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.04 CEILING EXHAUST AND RETURN REGISTERS/GRILLES (EGG CRATE)

- A. Manufacturers:
 1. Carnes Model Series RATB.
 2. Price Model Series 81.
 3. Krueger Model EGC5.
 4. Titus Model 50F.
 5. Substitutions: See Section 01 63 00.
- B. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch louvers.
- C. Fabrication: Aluminum with factory off-white enamel finish.
- D. Frame: 1-1/4 inch margin with countersunk screw mounting. Channel lay-in frame for suspended grid ceilings.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.05 CEILING EXHAUST AND RETURN GRILLES (PERFORATED)

- A. Manufacturers:
 1. Carnes Model Series RTFA.
 2. Price Model PDDR.
 3. Krueger Model 6290/6590.
 4. Titus Model PAR.
 5. Substitutions: See Section 01 63 00.
- B. Type: Perforated face with fully adjustable, round or square neck as indicated on the Drawings and removable face.
- C. Frame: As required for the ceiling type. In plaster ceilings, furnish plaster frame and ceiling frame.
- D. Fabrication: Steel with steel frame and baked enamel off-white finish.
- E. Accessories: Radial opposed-blade or butterfly damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.06 WALL SUPPLY REGISTERS/GRILLES

- A. Manufacturers:
 1. Carnes Model Series RTDB.
 2. Price Model Series 520.
 3. Krueger Model 880.
 4. Titus Model 300RL.
 5. Substitutions: See Section 01 63 00.
- B. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.
- C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

- D. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel finish.
- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.07 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Manufacturers:
 - 1. Carnes Model Series RSAB.
 - 2. Price Model Series 530.
 - 3. Krueger Model S80.
 - 4. Titus Model 350RL.
 - 5. Substitutions: See Section 01 63 00.
- B. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, horizontal face.
- C. Frame: 1-1/4 inch margin with countersunk screw mounting.
- D. Fabrication: Steel frames and blades, with factory off-white enamel finish.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.08 ROOF HOODS

- A. Manufacturers:
 - 1. Greenheck Model "Fabra Hood".
 - 2. Cesco Model EHA/IHA.
 - 3. Cook Model VI/VR.
 - 4. Carnes Model GI/GE.
 - 5. Substitutions: See Section 01 63 00.
- B. Fabricate air inlet or exhaust hoods in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Fabricate of galvanized steel, minimum 16 gage base and 20 gage hood, or aluminum, minimum 16 gage base and 18 gage hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake, and factory prime coat finish.
- D. Fabricate louver penthouses with mitered corners and reinforce with structural angles.
- E. Mount unit on minimum 12 inch high curb base with insulation between duct and curb, interior baffle with acoustic insulation, factory nailer strip.
- F. Make hood outlet area minimum of twice throat area.

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 conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified or shown as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 90 00.

END OF SECTION

SECTION 23 72 23
PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Energy recovery units.
- B. Vibration isolation.
- C. Power and controls.
- D. Accessories.
- E. Service accessories.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- B. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2014.
- C. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - 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. Samples: Submit sample showing custom paint colors.
- E. Manufacturer's Qualification Statement.
- F. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

- A. 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.
- B. The energy recovery ventilator shall be Certified by the Home Ventilating Institute (HVI) under CSA 439*. Both a heating and a cooling test must be run to demonstrate year round energy recovery.
- C. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.

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 78 00 - Closeout Submittals, for additional warranty requirements.
- B. The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of five years from the date of purchase.

PART 2 PRODUCTS**2.01 ENERGY RECOVERY UNITS**

- A. Manufacturers:
 - 1. Renewaire.
 - 2. Broan.
 - 3. American Aldes.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Continuous Ventilation: Unit shall have the capacity to operate continuously without the need for bypass, recirculation, pre-heaters, or defrost cycles under normal operating conditions.
- C. Construction:
 - 1. The energy recovery component shall be of fixed-plate cross-flow construction, with no moving parts.
 - 2. Unit shall be capable of operating in both winter and summer conditions without generating condensate.
 - 3. The unit case shall be constructed of 24-gauge steel, with lapped corners and zinc-plated screw fasteners. The case shall be finished with textured, powder coat paint.
 - 4. Access doors shall provide easy access to blowers, ERV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets.
 - 5. Case walls and doors shall be fully insulated with 1 inch, expanded polystyrene foam insulation faced with a cleanable foil face on all exposed surfaces.
 - 6. The ERV cores shall be protected by a MERV-8 rated, spun polyester, disposable filter in both airstreams.

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. Unit Location:
 - 1. Locate, orient, and connect ductwork per AMCA, ASHRAE, and SMACNA guidelines. Provide service clearances as indicated on the plans. Locate units distant from sound critical occupancies.

2. Use integral mounting flange and hanging bar system to mount the unit per manufacturer's installation manuals to a structurally suitable surface. The units may be mounted in any orientation.
- B. Vibration Isolation:
1. Utilize Neoprene pads for vibration isolation for the unit.
 2. Provide flexible duct connections at unit duct flanges.
- C. Duct Design:
1. All ductwork shall be designed, constructed, supported and sealed in accordance with SMACNA HVAC Duct Construction Standards and pressure classifications.
 2. At a minimum all duct runs to the outdoors shall be thermally insulated at levels appropriate to the local climate. A continuous vapor barrier shall also be provided on warm surface of the insulation.
- D. Test and Balancing:
1. Test and Balancing may not begin until 100% of the installation is complete and fully functional.
 2. Follow National Environmental Balancing Bureau (NEBB) air test and balance procedures specific to energy recovery devices. Provide balancing reports to owner's representatives.

3.03 CLEANING

- A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION

SECTION 23 74 13
PACKAGED OUTDOOR CENTRAL-STATION ROOFTOP UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged roof top unit.
- B. Unit controls.
- C. Roof mounting curb and base.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 49 - HVAC Seismic Restraint.
- B. Section 23 33 00 - Air Duct Accessories.
- C. Section 26 00 00: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

1.04 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 10 years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.07 WARRANTY

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional warranty requirements.
- B. Provide a five year warranty to include coverage for refrigeration compressors and heat exchangers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Trane Inc; Model Series Precedent: www.trane.com.

- B. Carrier Corporation; Model Series 48Z: www.carrier.com
- C. McQuay Model Series RPS: www.mcquay.com.
- D. Aaon Model Series RM/RL: www.aaon.com.
- E. Substitutions: See Section 01 63 00.

2.02 AIR CONDITIONING UNITS

- A. General: Roof mounted units having gas burner and electric refrigeration.
- B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan, economizer, and power exhaust.
- C. Electrical Characteristics:
 - 1. Refer to Section 26 00 00.
- D. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Division 26.

2.03 FABRICATION

- A. Cabinet: Galvanized steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners or doors with piano hinges and locking handle. Structural members shall be minimum 18 gage, with access doors or panels of minimum 20 gage.
- B. Insulation: 2 inch thick neoprene coated glass fiber with edges protected from erosion.
- C. Heat Exchangers: Stainless steel.
- D. Supply Fan: Forward curved centrifugal type, resiliently mounted with rubber isolated hinge mounted high efficiency motor, direct drive.
 - 1. Fan Assembly Mounting Furnish spring-type vibration isolators.
- E. Air Filters 2 inch thick glass fiber disposable media in metal frames.
 - 1. Filter Section:
 - a. Location: Upstream of fan section.
 - b. Furnish section with integral galvanized steel filter staggered rack contained within unit.
 - c. Disposable filters: Frame mounted 2 inch thick 30 percent efficient based on ASHRAE 52.
- F. Roof Mounting Curb 22 inches high galvanized steel with spring vibration isolators, channel frame with gaskets, nailer strips.

2.04 BURNER

- A. Gas Burner Atmospheric, induced draft, or forced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.
- C. High Limit Control Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
- D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

2.05 EVAPORATOR OR INDOOR COIL

- A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

- B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.06 COMPRESSOR

- A. Provide hermetic or semi-hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gage ports, and filter drier.
- B. Five minute timed off circuit to delay compressor start.
- C. Outdoor thermostat to energize compressor above 35 degrees F ambient.
- D. Provide step capacity control by cycling compressors, cylinder unloading, or cycling multi-speed compressors.

2.07 CONDENSER OR OUTDOOR COIL

- A. Provide copper tube aluminum or copper fin coil assembly with subcooling rows and coil guard.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.
- C. Provide refrigerant pressure switches or outdoor thermostat to cycle condenser fans.
- D. Refrigeration circuit:
 - 1. Dehydrate and factory charge each circuit with oil and refrigerant.
 - 2. Furnish the following for each circuit:
 - a. Thermal expansion device.
 - b. Filter-drier.
 - c. Replaceable core filter drier.
 - d. Suction, discharge, and liquid line service valves with gauge ports.
 - e. Sight glass.
 - f. High and low pressure safety controls.
 - g. Liquid line solenoid valve.
 - h. Sub-cooler circuit to provide 15 degrees of liquid sub-cooling.
 - 3. Capacity control:
 - a. By cycling compressors.
 - b. Hot gas bypass: Factory installed on each refrigerant circuit including hot gas bypass valve, solenoid valve and hot gas bypass piping.
 - 4. Furnish control to provide low ambient cooling to 0 degrees F.

2.08 OPERATING CONTROLS - SINGLE ZONE UNITS

- A. Electric solid state microcomputer based room thermostat.
- B. Room thermostat shall incorporate:
 - 1. Automatic switching from heating to cooling.
 - 2. Preferential rate control to minimize overshoot and deviation from set point.
 - 3. Set-up for four separate temperatures per day.
 - 4. Instant override of set point for continuous or timed period from one hour to 31 days.
 - 5. Short cycle protection.
 - 6. Programming based on weekdays, Saturday and Sunday.
 - 7. Switch selection features including imperial or metric display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
- C. Room thermostat display shall include:
 - 1. Time of day.

2. Actual room temperature.
 3. Programmed temperature.
 4. Programmed time.
 5. Duration of timed override.
 6. Day of week.
 7. System model indication: heating, cooling, auto, off, fan auto, fan on.
 8. Stage (heating or cooling) operation.
- D. Provide low limit thermostat in supply air to close outside air dampers and stop supply fan.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

3.02 INSTALLATION

- A. Roof Curb:
 1. Assemble roof curb.
 2. Install roof curb level.
 3. Coordinate curb installation and flashing with Architect.
 4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
 5. Install gasket material between unit base and roof curb.
- B. Connect units to supply and return ductwork with flexible connections. Refer to Section 23 33 00.
- C. Install condensate piping with trap and route from drain pan to splash block on roof.
- D. Install components furnished loose for field mounting.
- E. Install electrical devices furnished loose for field mounting.
- F. Install control wiring between unit and field installed accessories.
- G. Remove from roof and dispose off-site panels removed from units during installation of economizer and dampers.
- H. Locate remote panels as indicated on Drawings.
- I. Provide fixed sheaves required for final air balance.

3.03 INSTALLATION - NATURAL GAS HEATING SECTION

- A. Connect natural gas piping in accordance with NFPA 54.
- B. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
- C. Install the following piping accessories on natural gas piping connections.
 1. Strainer.
 2. Pressure gage.
 3. Shutoff valve.
 4. Pressure reducing valve.
- D. Install natural gas piping accessories above roof, within unit casing, or below roof.

3.04 MANUFACTURER'S FIELD SERVICES

- A. Section 01 40 00 - Quality Requirements: Requirements for manufacturer's field services.

- B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.
- C. Furnish services of factory trained representative for minimum of one day to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.05 CLEANING

- A. Section 01 74 00 - Cleaning: Requirements for cleaning.
- B. Vacuum clean coils and inside of unit cabinet.
- C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.06 DEMONSTRATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate unit operation and maintenance.
- C. Furnish services of manufacturer's technical representative for one 8 hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.

END OF SECTION

**SECTION 23 81 19
SELF-CONTAINED AIR-CONDITIONERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged terminal heat pump units.
- B. Wall sleeves.
- C. Louvers.
- D. Controls.

1.02 RELATED REQUIREMENTS

- A. Section 22 30 00 - Plumbing Equipment: Cooling condensate removal pumps.
- B. Division 26: Electrical characteristics and wiring connections.

1.03 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Include assembly instructions, support details, connection requirements, and start-up instructions.
- D. Operation and Maintenance Data: Provide maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

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.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

1.06 WARRANTY

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional warranty requirements.
- B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Amana Model PTHP: www.amaana-hac.com.

2.02 AIR CONDITIONING UNITS

- A. Description: Packaged, self-contained, through-the-wall air cooled terminal heat pump units, with wall sleeve, room cabinet, electric refrigeration system, electric heating, outside air louvers, remote temperature controls; fully charged with refrigerant and filled with oil.
- B. Electrical Characteristics:
 - 1. Refer to Division 26.
 - 2. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Division 26.

3. Provide for hardwiring of the unit. Manufacturer's sub-base kit.
- C. Energy Efficiency:

2.03 CABINET

- A. Discharge Grille and Access Door: Removable or integral punched louver or extruded aluminum discharge grilles, allowing 4-way discharge air pattern with hinged door in top of cabinet for access to controls.
- B. Wall Cabinet: Matching cabinet in construction and finish, allowing diversion of 40 percent of unit air flow to adjoining room, with grille.

2.04 WALL SLEEVES AND LOUVERS

- A. Wall Sleeves: 13-3/4 inches deep, 16 gage galvanized steel with protective mastic coating, heavy sound insulation - STC 31..
- B. Louvers: Flush or Companion flanged anodized aluminum with enamel finish, color as selected, oversized custom per Architect design, Reliable Louver, or equivalent.

2.05 CHASSIS

- A. Refrigeration System:
 1. Direct expansion cooling or indoor coil.
 2. Hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection.
 3. Accumulator.
 4. Condenser or outdoor coil and fan.
- B. Coaxial tube in tube condenser with water regulating valve.
 1. Capillary restrictor and constant pressure expansion valve.
 2. Reversing valve.
- C. Air System: Centrifugal forward curved tangential evaporator or indoor fans with two speed permanent split capacitor motor, permanent washable filters, positive pressure ventilation damper with concealed manual operator.
- D. Heating Coil: Electric.
- E. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation.
- F. Condenser or Outdoor Fan: Centrifugal, forward curved or propeller type with separate permanent split capacitor motor.

2.06 CONTROLS

- A. Control Module: Low voltage remote mounted adjustable thermostat with heat anticipator, heat-off-cool switch, high-low fan switch. Honeywell Lyric 46 PRO.
- B. Low Ambient Lockout Control: Below 35 degrees F, outdoor thermostat shall prevent compressor operation and switch to heat mode.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate installation of units with architectural, mechanical, and electrical work.

END OF SECTION

SECTION 23 81 26
SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Air-source heat pumps.
- B. Indoor ductless fan coil units.
- C. Refrigerant piping.
- D. Refrigerant Piping Insulation.

1.02 RELATED REQUIREMENTS

- A. Section 23 31 00 - HVAC Ducts and Casings.
- B. Division 26: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008.
- B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2008.
- C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2016, with Addendum (2017).
- D. ASHRAE Std 23.1 - Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; 2010.
- E. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017.
- F. 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.
- G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- H. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Design Data: Indicate refrigerant pipe sizing.
- E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- F. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- G. Project Record Documents: Record actual locations of components and connections.
- H. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- I. Warranty: Submit manufacturers 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.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Units shall be listed by ETL (Engineering Testing Laboratory) and be evaluated in accordance with UL standard 1995, 4th. edition.
- B. Units shall be listed in the AHRI directory.
- C. All units shall meet the Federal minimum efficiency standards and be tested per AHRI 210/240 Standard.
- D. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of documented experience .

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Units shall be shipped in one piece and shall be stored and handled per unit manufacturer's recommendations.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturers warranty for heat exchangers, condensing units, and compressors.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
 - 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; indoor.

2.02 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

- A. Manufacturers:
 - 1. Carrier/Toshiba.
 - 2. Daikin.
 - 3. Mitsubishi.
 - 4. LG.
- B. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
 - 1. Air Flow Configuration: Counterflow, with additional steel base.
 - 2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
- C. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
 - 1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
 - 2. Motor Electrical Characteristics:
 - a. Refer to Division 26.
- D. Air Filters: Field built filter box for MERV 8, disposable pleated filters.

- E. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.

2.03 HIGHWALL INDOOR UNITS FOR DUCTLESS SYSTEMS

- A. Manufacturer:
1. Carrier/Toshiba.
 2. Daikin: www.daikin.com.
 3. LG: www.lghvac.com
 4. Mitsubishi Electric: www.mrslim.com.
- B. Indoor Units:
1. The indoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Both liquid and suction lines must be individually insulated between the outdoor and indoor units.
 2. Unit Cabinet:
 - a. The indoor unit shall have a white, "flat screen" finish.
 - b. The drain and refrigerant piping shall be accessible from six (6) positions for flexible installation (right side, right back, and right bottom; and left side, left back, and left bottom).
 - c. The cabinet shall be supplied with a mounting plate to be installed onto a wall for securely mounting the cabinet.
 - d. Provide with zero-position EEV for systems with variable flow/multiple indoor units.
 3. Fan:
 - a. The evaporator fan shall be an assembly consisting of a direct-driven fan by a single motor.
 - b. The fan shall be statically and dynamically balanced and operate on a motor with permanent lubricated bearings.
 4. Filter:
 - a. The return air filter provided will be a mildew proof, removable and washable filter. Titanium apatite, photocatalytic air purifying filters are included as standard.
 5. Coil:
 - a. The evaporator coil shall be a nonferrous, aluminum fin on copper tube heat exchanger.
 - b. All tube joints shall be brazed with silver alloy or phoscopper.
 - c. All coils will be factory pressure tested.
 - d. A condensate pan shall be provided under the coil with a drain connection.
 6. Electrical:
 - a. The outdoor unit shall be powered with 208-230 volts, 1 phase, and 60 hertz power. The indoor unit shall receive 208-230 volt, 1 phase, 60 hertz power from the outdoor unit.
 7. Control:
 - a. The unit shall have a backlit, wired controller. 7-day programmable with auto change over, independent heating and cooling setpoints.
 8. Accessories: Condensate pump.

- C. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
- D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
 - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
 - 2. Manufacturer: System manufacturer.
- E. Remote Actuators:

2.04 OUTDOOR UNITS - HEAT PUMPS (INVERTER DRIVEN)

- A. Manufacturers:
 - 1. Daikin; Model RXTG: www.daikin.com.
 - 2. Mitsubishi Electric: www.mrslim.com.
 - 3. LG: www.lghvac.com.
- B. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be complete factory assembled and pre-wired with all necessary electronic and refrigerant controls.
 - 1. Comply with AHRI 210 and AHRI 520.
 - a. Refrigerant: R-410A
 - b. Construction and ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207 listed
 - c. Sound ratings as scheduled when measured in accordance with AHRI 270.
- C. Unit Cabinet:
 - 1. The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.
- D. Fan:
 - 1. The fan shall be a direct drive, propeller type fan.
 - a. The motor shall be inverter driven, permanently lubricated type bearings, inherent.
 - b. A fan guard is provided on the outdoor unit to prevent contact with fan operation.
 - c. Airflow shall be horizontal discharge.
- E. Coil:
 - 1. The outdoor coil shall be nonferrous construction with corrugated fin tube.
 - a. Refrigerant flow from the condenser will be controlled via a metering device.
- F. Compressor:
 - 1. The compressor shall be a variable speed inverter driven scroll compressor.
 - a. The outdoor unit shall have an accumulator.
 - b. The compressor shall have an internal thermal overload.
 - c. Comply with AHRI 520.
 - d. Spring mounted.
- G. Electrical:
 - 1. The electrical power requirement is 208-230 volt, 1-phase, and 60 Hz power.
 - a. The outdoor shall be controlled by a microprocessor located in the outdoor and indoor units via commands from the infrared remote controller.

- H. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

2.05 SYSTEM REFRIGERANT PIPING

- A. Refrigerant Piping:
1. Copper Tube: ASTM B 280, Type ACR.
 2. Wrought-Copper Fittings: ASME B16.22.
 3. Brazing Filler Metals: AWS A5.8/A5.8M.
 4. Insulation: Insulate both heat pump refrigerant lines. Insulate all three refrigerant lines from heat recovery outdoor units to MCU.
- B. Refrigerant Tubing Kits:
1. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
 2. Modular systems require outdoor refrigerant kits for module connections.
 3. Standard one-piece length for connecting to indoor units.
 4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
 5. Factory Charge: Dehydrated air or nitrogen.
- C. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.
1. Indoor Y-Joint Fittings: Piping to multiple indoor units requires additional piping components. Use VRF HVAC system manufacturer's Y-joint fittings to branch the main refrigerant lines.
 2. Outdoor Y-Joint Fittings: VRF HVAC system manufacturer's Y-joint fittings must be used to connect outdoor units when multiple module systems are being installed (systems with more than one outdoor unit).
- D. Refrigerant Isolation Ball Valves:
1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
 2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
 3. Valve Connections: Flare or sweat depending on size.

2.06 PIPING AND TUBING INSULATION

- A. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:
1. Flexible Elastomeric Insulation:
 - a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
 - b. Thickness: Per Code.
- B. Refrigerant Tubing Insulation and Jacket Requirements:
1. Flexible Elastomeric Insulation:
 - a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
 - b. Thickness: Per Code.

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 in correct location.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Check and verify location of thermostats and exposed control sensors with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches.
- C. Install in accordance with NFPA 90A and NFPA 90B.
- D. Install refrigeration systems in accordance with ASHRAE Std 15.
- E. Consult with roofing manufacturer prior to installation of equipment base. Provide roofing material or rubber pads to protect roof as required by roofing manufacturers/

END OF SECTION

**SECTION 23 82 16
AIR COILS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electric coils.

1.02 RELATED REQUIREMENTS

- A. Section 23 31 00 - HVAC Ducts and Casings: Installation of duct coils.
- B. Section 26 00 00 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Product Data: Provide coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
- C. Shop Drawings: Indicate coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
- D. Certificates: Certify that coil capacities, pressure drops, and selection procedures meet or exceed specified requirements.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 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.

PART 2 PRODUCTS

2.01 ELECTRIC COILS

- A. Manufacturers:
 - 1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
 - 2. Warren Technology: www.warrenhvac.com.
 - 3. Substitutions: See Section 01 63 00.
- B. Assembly: UL listed and labelled, with terminal control box and hinged cover, splice box, coil, casing, and controls.
- C. Coil: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.
- D. Casing: Die formed channel frame of 16 gage galvanized steel with 3/8 inch mounting holes on 3 inch centers. Provide tube supports for coils longer than 36 inches. Provide UL rated NEMA 3R enclosure for all units exposed on roof.
- E. Controls: Automatic reset thermal cut-out, built-in magnetic contactors, control circuit transformer and fuse, manual reset thermal cut-out, air flow proving device, fused disconnect, load fuses.

- F. Electrical Characteristics:
 - 1. Refer to Section 26 00 00.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturers written instructions.
- B. Install in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 - 1. Support coil sections independent of piping on steel channel or double angle frames and secure to casings.
 - 2. Provide frames for maximum three coil sections.
 - 3. Arrange supports to avoid piercing drain pans.
 - 4. Provide airtight seal between coil and duct or casing.
 - 5. Refer to Section 23 31 00.
- C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.
- D. Install coils level. Install cleanable tube coils with 1:50 pitch.
- E. Make connections to coils with unions and flanges.
- F. Electric Duct Coils: Wire in accordance with NFPA 70. Refer to Division 26.

END OF SECTION

SECTION 26 00 00
ELECTRICAL DESIGN BUILD REQUIREMENTS

PART 1 GENERAL

1.01 PROJECT DESCRIPTION

- A. It is expected that each of the individual Design-Build subcontractors will evaluate this information, provide additional recommendations/input, and be responsible for the final design throughout the design-build process.

1.02 REQUIREMENTS

- A. Definitions from General Conditions:
1. Complementary Documents: The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all.
 2. Performance by Electrical Installer: Required only to the extent consistent with Contract Documents and reasonably inferable from them as being necessary to produce the intended results.
 3. Provide all materials, equipment, and labor necessary for a complete and operable electrical system.
 4. All electrical work shall comply with applicable code requirements.
 5. All materials shall be listed by an approved listing agency.
 6. The installation of outlets and devices shall be as shown on the drawings and meet the code requirements which apply to this installation.
 7. Fixture or device location changes must be approved by the authorized owner's representative.
 8. Electrical plan review information shall be provided by the electrical contractor as required by AHJ.
- B. Definitions for this Project:
1. Work By Electrical Contractor: Electrical Contractor shall perform Work in this Division and Work indicated on Electrical Drawings, and as described in these specifications except where indicated otherwise.
 2. Mounting heights: Per ADA and FHA guidelines.
- C. Design-Build Approach:
1. General Requirements:
 - a. Design and documentation, including drawings, calculations, and specifications required in establishing and coordinating the requirements for construction; including all permitting of the noted disciplines will be the responsibility of the Design-Build team and will be concurrently with the established project format and schedule. The Design-Build subcontractors will participate in the design process and meetings and will provide the Architect's design team with professional input, design documentation, and other information as needed to coordinate space needs and other general considerations.
 2. Submittals: The electrical contractor shall provide electronic submittals for service equipment, wiring devices, heating equipment, and light fixtures. The electrical contractor shall provide low voltage system submittals including fire alarm, access control, telephone, data, and cable TV.
 3. Closeout Submittals: Provide As-built Drawings and Operation and Maintenance Manuals complying with requirements in Section 01 70 00 - Execution and Closeout Requirements.
 4. Product Qualifications:

- a. Furnish new products which are of current manufacture, suitable and approved by manufacturer for intended use.
- b. Furnish similar and identical items from one manufacturer.
- c. Factory modify products as required to conform to specified requirements.
5. Scheduling Site Utility Work:
 - a. Schedule temporary power outages with the Owner's Representative.
 - b. Schedule underground site work to avoid conflicts with contractors installing sewers and water lines.
 - c. Common trenches may be used where code required clearances are maintained.
6. Manufacturer's Warranty:
 - a. Provide a written limited warranty against defects in materials and labor for electrical Work for one year after date of acceptance of electrical systems and components by Owner's Representative, except provide lamp manufacturer's standard lamp warranty, and provide apparatus manufacturer's standard apparatus warranty.
 - b. Repair or replace defective apparatus and equipment.
 - c. Correct system damage caused by component failures.
 - d. Replace work which develops defects within the warranty period, except where defect is from abuse by Owner or building occupants.
7. Design Documentation: Develop all Electrical, Lighting, and Low-Voltage designs using documentation compatible with AutoCAD 2019 or later. Drawings shall include panelboard schedules.
8. BIM: Provide BIM Modeling of MC cable feeders 200 amps and larger, and conduits 2" and larger.
9. Power Plan drawings shall include labeling of all equipment scheduled for connection, including name of equipment, load and voltage. Equipment tag referenced to an equipment schedule is acceptable.
10. All home runs shall be labeled with panel name and circuit number.
11. Feeder circuit breaker size and number of poles shall be labeled on one line.
12. Submit 1/4" scale typical unit plans and electrical room layouts.
13. Submit 1/8" scale minimum design drawings which indicate location of outlets, boxes, devices, panelboards, switchgear, motor starters, luminaires, switches, and disconnects on floor plans.
14. Submit lighting calculations except in areas where lighting was selected and laid out by the Architect. Submit emergency lighting calculations for any area of the building if required by authority having jurisdiction.
15. Submit design drawings for review by Architect's Representative in accordance with design schedule, including progress drawing submittals.
16. Submit electrical load calculations for all panels and main service.
- D. Performance/Scope of Work:
 1. Electrical contractor shall install materials and equipment in a neat and workmanlike manner.
 2. If work area is clean at the start of the installation, it shall be left clean after the installation is complete.
 3. Furnish and install the following items:
 - a. All electrical devices, electric heaters in apartments units, and equipment.
 - b. Lighting and controls.

- c. Cable TV/telephone outlets/cable.
- d. Data networking devices/cable.
- e. Access control system.
- f. Fire alarm system.
4. Performance Requirements:
 - a. Continuous Service: Maintain temporary continuous electrical service to all areas of the Site until Substantial Completion.
 - b. Power Outages: Electrical Contractor will be responsible for damage caused by unscheduled power, signal and communications outages which are a result of the Electrical Contractors work.
5. Provide power to heating and cooling equipment as required - see Mechanical for system information. HVAC system to be as desired in HVAC design-build documents.
6. Provide assistance and supporting information for lighting rebates with Energy Trust of Oregon, including but not limited to final fixture information and quantities.
7. Prepare Oregon Energy Code Lighting Compliance Forms.
8. Provide lighting input for coordinated ceiling plan.
9. Permits/Plan Review Fees: Pay for all electrical and low voltage plan review and permit fees.
- E. Quality Assurance Submittals:
 1. Submit Electrical and low voltage system design drawings.
 2. Submit shop drawings fully coordinated with all Mechanical, Plumbing, and Fire components.
 - a. Content and View: Two views, concealed conditions and visually exposed conditions, shown as reflected plans. Indicate actual size of components at scale sufficient to show no interference and adequate space for installation and maintenance of each component.
 - b. Overlay drawings by mechanical showing all Electrical, Plumbing, and Fire systems. Coordinate until all conflicts are resolved. Provide single point of overlaying.
- F. Unit Standards:
 1. Change one code required 120V outlet to a combo USB/Duplex 120V outlet in each apartment unit kitchen. Exact location to be selected by Architect.
 2. Light fixture schedule and lighting layout will be provided by Architect. Design Build Electrical will complete documentation and design after the Design Development phase is delivered. See bid form or allowance requirements.
 3. Entry: Switch and LED puck light fixture.
 4. Kitchen: Provide switch, and three (3) puck lights in linear kitchens, and four (4) puck lights in L-shaped kitchens, and LED undercabinet lights. Provide 2 LED surface lights at kitchen islands and peninsulas, kitchen appliance wiring, provide counter mount air switch for disposal control, and convenience duplex outlet receptacles.
 5. Dining: Switch and pendant fixture, and duplex outlets.
 6. Living: Switch and half switched outlet, duplex receptacles, TV/Data jack, and duplex convenience outlets. PTHP unit and supplemental fan forced electric heater and separate line voltage stat. Locate fan forced heater high on wall.
 7. Hall: Switch and surface fixture(s). 3-wayswitch light(s) for long halls. Minimum of one duplex outlet.

8. Bathroom: Switch and surface mount light bar above sink, and one GFCI receptacle. Provide wet label puck light centered over tub/shower.
 9. Master Bathroom: Switch and surface mount LED light bar, GFI duplex receptacle at sink.
 10. Bedrooms: Switch and surface mount LED puck light, TV/Data jack, fan forced electric heater with remote stat, and duplex outlets.
 11. Balcony: Weatherproof GFCI duplex outlet.
 12. Confirm electrical panel location and mounting height with inspector prior to installation. Panel covers to be factory painted white.
 13. Locate thermostats as close to corners of walls as possible.
 14. Unit lighting requirements may be superseded by other direction in the contract documents.
 15. Assume electric ranges in apartments.
 16. Provide Decorra style switches and outlets in apartment units.
- G. General Design Requirements for Electrical Service:
1. Comply with Federal, State, and Local Building Codes, Ordinances and Regulations.
 2. Provide temporary electrical service as required by Section 01 50 00, Construction Facilities and Temporary Controls.
 3. Provide disconnects as required by NEC.
 4. Design and install underground service to meet utility requirements.
 5. Design services for 120/208 Volts, 3 phase to accommodate design loads.
 6. Basis of Design:
 - a. Building 1: One (1) 2,500-amp, 120/208 volt, 3 phase, 4 wire service to serve apartment units, and to serve house loads. Intent is to use pad mounted utility transformer.
 - b. Building 2: One (1) 2,500-amp services, 120/208 volt, 3 phase, 4 wire. Service to serve apartment units and house loads.
 - c. Building 3: One (1) 3,000-amp services, each at 120/208 volt, 3 phase, 4 wire. Service to serve apartment units, house loads, and retail space. Provide two 200 amp, 120/208 volt, 3 phase meters for retail space.
 - d. Building 4: One (1) 320 amp, 120/240 volt, 1 phase, 3 wire service with two (2) 200 amp 120/240 volt, 1 phase, 3 wire panels to serve clubhouse load, including pool equipment.
 - e. Building 5: One (1) 400 amp, 120/208 volt, 3 phase, 4 wire service, with CT metered, main breaker 400 amp panel.
 7. Provide primary and secondary conduits, transformer pads and pad/vaults, and splice vaults per PGE requirements.
 8. Provide all utility coordination and calculations. Provide all grounding, trenching, backfill, etc., for complete installation of utility supplied transformer.
- H. Design Requirements for Electrical and Distribution (Apartments):
1. Apartment panels shall be a minimum of 100 amps, 120/208 volts, 1 phase load center with the number of breaker spaces as needed to serve loads.
 2. House panels to be 100A (or larger) amp, 120/208-volt, 3 phase dead front panelboard with a minimum of 42 spaces.
 3. Metering equipment shall be residential self-contained, UESERC compliant, NEMA 3R, 125 amps per socket, minimum. 100-amp, 2 pole breaker shall feed services, minimum.
- I. Design Requirements for New Electrical Power Circuits (Common Space):

1. Design power circuits for elevators.
 - a. Design power circuits for exhaust fan or air conditioning serving elevator equipment room.
 - b. Design power circuits for new elevator shaft, pit, and equipment room.
2. Design separate circuits with photocell or astronomic time clock control for night lighting.
3. Provide disconnects as required by NEC for equipment. Disconnects shall be general duty or heavy duty, NEMA 1 or 3R (depending on application), either fused or non-fused as needed, enclosed knife blade type.
4. Branch circuit breakers shall be molded case, thermo-magnetic type, inverse time trip, plug on style, with an AIC rating greater than the available fault current. Arc fault breakers shall be provided for circuits serving bedrooms and living rooms as required by NEC.
5. Provide power connections for all HVAC equipment.
 - a. Provide power connections for electric heaters for freeze protection for all equipment rooms and stairwells to prevent fire sprinkler pipe from freezing.
6. Provide power connections to trash three (3) compactors, ie one per residential building.
7. Provide convenience outlets in corridors at a maximum spacing of 50ft on center.
8. Provide connection to heat trace equipment in unheated portions of the building. Plumbing contractor will furnish heat trace cable, electrical contractor will install.
9. Provide electrical power and control connections for two (2) gas grills, two (2) outdoor fire places, and two (2) Electric Vapor fireplaces.
10. EV Chargers and EV Charger Rough-In:
 - a. Chargers: Provide six (6) future dual head, level 2 electric vehicle chargers installed complete. Locate as directed. Connect to nearest house panel. Chargepoint pedestal mount dual head, CMK6.
 - b. Rough in: Provide panel capacity, spare 40 amp, 2-pole circuit breakers, 1" conduit to six (6) locations, to accommodate six (6) future dual head level 2 electric vehicle chargers. Locate on site as directed. Route conduit to nearest house panel.
11. Provide 120 Volt power to two (2) monument signs located on the project site.
12. Telecom backboards: at minimum, provide one (1) dedicated 120 volt quad outlet per low voltage system installed in any given IDF room.
13. Televisions in common areas: Provide 120V duplex receptacle for each TV.
14. Copiers in office: 120V dedicated duplex outlet.
15. Offices: provide three (3) duplex receptacles per office.
16. Amenity spaces: provide convenience outlets spaced appropriately for type of amenity space.
17. Co-Working and maker spaces: Provide combo USB / Power outlets at work booths, seating areas, and work counters, 4' on center at counters. Provide minimum outlet spacing of 12' on center for wall outlets, adjust locations as directed.
18. Provide outlets/power connections for all appliances in offices/amenity spaces.
19. Outlets in office/work station areas shall be quad type; provide one (1) for every telecom outlet that is required.
20. Minimum of six (6) additional duplex outlets in maintenance room.
21. Provide additional outlets as indicated on interior design plans.
22. 120V outlets in Attic for future radon fans. See plumbing.
23. Bike storage: provide one 120-volt duplex outlet for vending, and one at bike repair area.

24. Provide dedicated 20-amp, 120-volt dedicated circuit for each package delivery room/locker system.
25. Provide weatherproof outlet for seasonal lighting at each tree well, each building entrance canopy, and one per awning at retail building/space frontages.
26. Provide 120 volt power and 2" conduit stub from electrical room to landscape area for landscape controller. Assume two locations total.
27. Provide 120 volt connection to one (1) building sign at each of four buildings.
28. Design Requirements for Electrical Conduit and Circuits (Future Space):
 - a. Each retail space to have stumble lighting and electric freeze protection installed.
 - b. Each retail space to have two (2) 1 inch conduits installed from low voltage entrance to each tenant space.
 - c. Building 3 tenant space to have two (2) 200 amp, 120/208 volt, 3 phase, 42 circuit panelboards installed. Coordinate location with owner.
29. Design requirements for Emergency Power System:
 - a. Provide diesel engine driven emergency generators to provide emergency and legally required standby power. Design intent is for one generator to serve Building 1, and one generator to serve Buildings 2 and 3.
 - b. Generators will be pad mounted, and located on site.
 - c. Generators to have sub base tanks and sound attenuated weatherproof enclosures.
 - d. Emergency loads include emergency lighting, exit signs, generator accessories, and other items required by code to be connected to emergency back up power.
 - e. Legally required standby loads include accessible egress elevators, and associated accessories.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements.

1.04 BASIC MATERIALS AND METHODS

- A. Unit Smoke Detectors:
 1. Units will be provided with combination carbon monoxide and smoke alarms that alarm within unit only.
 2. All smoke detectors within each unit shall be linked together.
 3. Detectors shall comply with the Fire Department and Building Department requirements, ADA and IBC Life Safety System requirement.

1.05 LIGHTING DESIGN CRITERIA

- A. The project lighting designer will provide all light fixture selections for the project with the exception of "back of house" lighting. Light back of house with functional fixtures per applicable codes and standards. Color temperature of all luminaires shall be 3000K.
- B. Lighting selections will be finalized by the end of the Design Development phase of work, at which time the electrical design-builder will carry the lighting schedule on drawings for final coordination and construction.
 1. Additional General Requirements:
 - a. Corridors: 6" LED Puck lights, approximately 12' on center.
- C. Commencing at the start of the Construction Document phase, the design builder will assume responsibility for the lighting fixture schedule, lighting layouts and associated coordination, light levels, energy code compliance, and controls.
- D. Project Lighting Budget: contractor to carry a lump sum lighting budget for fixtures until design progresses and fixtures are selected.

- E. Control: Provide photoelectric switch control of exterior building luminaires indicated on architectural plans.
- F. Emergency lighting power shall be supplied by battery inverter.
- G. Occupancy Sensors: Install as required by applicable code as well as to control the lighting in the mail room, work room, recycle room, trash room, and fitness room. Stairwell fixtures to have integral occupancy sensors.
- H. Refer to Landscape drawings for Landscape Lighting requirement.
- I. Provide pole mounted parking lot lighting per City of Beaverton municipal requirements.

1.06 LIGHTING EQUIPMENT

- A. Luminaires installed under canopies, roof or open porches and similar damp or wet locations shall be UL approved and labeled as suitable for damp or wet locations.
- B. Exterior Canopy Fixtures: Per architectural plans.
- C. Exterior Wall Sconces: Per architectural plans.

1.07 ACCESSIBLE ELEVATOR LANDING TWO WAY COMMUNICATION SYSTEM

- A. Provide master station. Locate per AHJ requirements. Provide dial out.
- B. Provide area station at each elevator landing except at level of discharge.
- C. Applicable codes include, but not limited to OSSC requirements.

1.08 TELEPHONE AND CABLE TV SYSTEM DESCRIPTION

- A. Install conduit and telephone terminal board for telephone service as required by telephone utility, locate as required. Verify all requirements with Telephone Utility Company and cable TV company. Assume three (3) low voltage providers.
- B. Provide conduit riser between phone closets for low voltage cabling, min. four (4) 4" conduit sleeves.
 - 1. Provide four (4) 2" C from MPOE to each IDF stack.
 - 2. Provide two (2) 4'x4' plywood backboards in each IDF in addition to other backboards and racks specified elsewhere.
- C. Provide one (1) 42" tall non-metallic recessed media distribution panel with hinged cover in each apartment unit. Provide with (2) 120-volt duplex outlets. Configurable for 3 service providers. Leviton.
- D. Coordinate trunk line cabling requirements with low voltage providers, and provide per providers' requirements.
- E. Provide one CAT 6 cable w/ RJ-45 terminations, and one RG-6 COAX cable w/ F connectors in a single faceplate at each TV / Data outlet in apartment units. Route cable and terminate in MDU panel. Provide one outlet in each living room and each bedroom.
- F. Telephone/Data and video outlets in common spaces:
 - 1. Offices: Two (2) outlets each with two (2) CAT 6 jacks.
 - 2. Work Stations: One (1) outlet with two (2) CAT 6 jacks (includes workstation(s) in maintenance area).
 - 3. Copier(s): One (1) outlet with (2) CAT 6 jacks.
 - 4. Common Area televisions in Each Residential Lobby and Amenity Room: One (1) outlet per location with one (1) CAT 6 jack and one (1) RG-6.
 - 5. Mood Music: Provide one (1) outlet with one (1) CAT 6 jack.
 - 6. Other Code Required Outlets: Cat 6 jacks at locations including but not fire alarm panel, elevator, elevator egress communication panel, and the like.
 - 7. Fitness Area: One (1) outlet per piece of cardio fitness equipment each with one
 - 8. (1) CAT 6 jack and one (1) RG-6 jack. Assume a total of 9 pieces of fitness equipment.

9. Package Delivery Room: Install access control locking equipment, video camera, and connection to each package delivery system.
- G. Wireless Network: Provide wireless network system including cabling and wireless access points. Provide coverage for all common areas, except corridors. Coordinate equipment requirements with owner.
 1. WAN Infrastructure: TBD.
 2. LAN Infrastructure: CAT 6 cables from patch panels in IDF/MDF to RJ-45 jacks located by Contractor as needed.
 - a. Assume minimum of one CAT 6 cable to be 50' on center in common areas, other than corridors for WAPs.
 - b. Provide swing out wall mount data racks for patch panels/ethernet switches in each IDF closet.
 - c. Provide 6 strand single mode fiber optic cable between MPOE and each IDF closet and terminate in fiber patch panel with SC connectors.

1.09 ACCESS CONTROL SYSTEM DESCRIPTION

- A. Design, furnish, and install complete access control system to allow individual units remote entry to front door visitor. Manufacturer: Latch, no substitutions.
- B. Provide access control system to allow card entry from the following locations:
 1. Exterior doors, amenity space doors, and other locations as indicated on architectural plans.
- C. Main Entries: Provide Latch OS Intercom, camera, access control.
- D. Parcel Rooms: Latch Delivery assistant
- E. Apartment unit doors: Latch M.

1.10 VIDEO SURVEILLANCE SYSTEM

- A. System: TBD
- B. Camera Locations: TBD

1.11 DISTRIBUTED ANTENNA SYSTEM

- A. Not required. Fee will be paid by owner in lieu of installing system.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

- A. The intent of this Division's Specifications and Drawings is to provide a complete and workable facility, with complete systems as required by applicable codes, as indicated, and as specified.
- B. Provide a complete and workable facility with complete systems that comply with the requirements of the state codes, local codes, and other authorities having jurisdiction. Include design, labor and materials required to install, test and place into operation the systems as called for in the Contract Documents and according to applicable codes and regulations.
- C. Specifications and the accompanying Drawings are complementary and what is called for by one is as binding as if called for by both.
- D. The General and Supplemental Conditions apply to this Division, including but not limited to:
 - 1. Drawings and Specifications.
 - 2. Public ordinances and permits.
 - 3. Payments and fees required by governing authorities for work of this Division.
- E. The Drawings that accompany this Division are diagrammatic. They do not show every offset, bend, tee, or elbow, which may be required to install work in the space provided and avoid conflicts with other construction.
- F. Provide all connections, raceway, wiring, breakers and installation required for systems specified, as required by the manufacturers installation documents, and for complete system functionality.
- G. Offsets and transitions are to be assumed at a minimum at each crossing of services, structural penetrations through shear walls or beams, structural grids, where ceiling heights are restricted, and at piping and conduit mains.
- H. Follow the Drawings as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions, and without additional cost to the Owner. Significant deviations from the routing shown on the drawings is subject for approval prior to installation. The right is reserved by the design team to make reasonable changes in locations of system components prior to roughing-in, without cost impact.
- I. Verify dimensions, field conditions, quantities, and measurements prior to installing work.
- J. Work done under this Division of the specifications includes the furnishing of labor, material, equipment, and tools required for the complete installation of the work indicated on the Drawings or as specified herein.
- K. Work installed contrary to Drawings and Specifications is subject to change as directed by the Owner and no extra compensation will be allowed for making those changes.

1.02 PRICE AND PAYMENT PROCEDURES

- A. Allowances
 - 1. Comply with Division 01, General Requirements.
- B. Alternates
 - 1. Comply with Division 01, General Requirements.
 - 2. Alternates related to electrical systems:

- a. Project Base (provide description of project base as relates to electrical system)
 - b. Project Alternate (provide description each alternate as relates to electrical system)
3. Refer to Drawings for detailed information relating to the appropriate alternates.

1.03 RELATED REQUIREMENTS

- A. Division 00, Procurement and Contracting Requirements
- B. Division 01, General Requirements
- C. Division 07, Thermal and Moisture Protection
- D. Division 08, Openings
- E. Division 09, Finishes
- F. Division 11, Equipment
- G. Division 21, Fire Suppression
- H. Division 22, Plumbing
- I. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)
- J. Division 25, Integrated Automation
- K. Division 26, Electrical
- L. Division 27, Communications
- M. Division 28, Electronic Safety and Security
- N. Division 31, Earthwork
- O. Division 33, Utilities

1.04 REFERENCE STANDARDS

- A. Refer to individual sections under this Division for applicable reference standards
- B. Abbreviations and Acronyms
- C. Definitions
- D. FAR American Recovery and Reinvestment Act.
- E. Buy American Act construction materials.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 1. Review Drawings of other trades and Owner provided equipment to avoid conflicts.
 2. Report potential conflicts to Architect, provide resolution prior to rough-in.
 3. Architectural Drawings take precedence regarding exact placement of system components and equipment.
 4. Verify the physical dimensions of equipment to fit the space available.
 5. Coordinate access routes through the construction, equipment move-in planning, and provide all required equipment, transport and services necessary to facilitate installation of equipment.
 6. Where connections are required for equipment provided as Work of other Divisions, coordinate rough in and connection requirements for that equipment with its supplier and installer prior to commencing work.

7. Notify Architect of any discrepancies between the actual rough in and connection requirements, and those identified on Drawings for resolution prior to installation.
 8. Coordinate underground work with other trades working on the site.
 - a. Common trenches may be used with other trades, providing clearances required by codes and ordinances are maintained.
 9. Coordinate installation of required supporting devices and set sleeves in architectural and structural components as they are constructed.
 10. Coordinate location of access panels and doors for items concealed behind finished surfaces with Architect.
 11. Coordinate sleeve selection and application with firestopping specified elsewhere.
 12. Finishes: Coordinate with Architect, finish to match surrounding surfaces.
 13. Layout Drawings:
 - a. The documents represent the design intent for the systems on the project. They do not indicate means and methods.
 - b. For projects with existing conditions and renovations, the documents do not represent the installed systems or installations.
 - c. Equipment arrangement shown on Drawings is diagrammatic to indicate general equipment sizing and spatial relationship. Include, as part of distribution equipment submittal, a scaled floor plan, which includes equipment shown with their submitted sizes. Include all feeder conduit routing, both aboveground and underground, including termination points at equipment. Submit for Engineer's review prior to commencing work.
 - d. Provide additional wiring details at switchboards, motor control centers, and other areas where work is of sufficient complexity to warrant additional detailing for coordination.
 - e. Equipment layouts will comply with all code required clearance and working areas and any additional required maintenance clearance and access areas.
 - f. Submit layout drawings for approval prior to commencing field installation.
 14. Arrange raceways, wiring, and equipment to permit ready access to switches, motors, and control components.
 - a. Keep doors and access panels clear.
 15. Coordinate electrical, telephone, and other utility services with the appropriate serving utility.
 - a. No additional compensation will be allowed to the Contractor for connection fees or additional work or equipment required by the serving utility, but not covered in the Drawings or Specifications.
- B. Sequencing
1. The electrical work of this project is complex in nature and has an inherent sequence, which may not be readily discernable.
 2. Implement construction sequences to be the least impactful possible to current facilities and services. Where current services are required to be maintained, provide necessary equipment such temporary generators and all connections to minimize downtime and cutovers.
 3. Submit construction sequences for review and coordinate sequencing with other trades.
 4. Construction sequences may be provided as part of the design documents. Where provided, review, provide comments and input. The sequences indicate the general natural of the work are provided as a guide. Provide further development of the construction sequences as required to perform the work.
- C. Permits
1. Obtain permits and inspections for the installation of work and pay charges required. Deliver certificates of inspection issued by authorities to the Owner.

1.06 SUBMITTALS

- A. General Submittal Requirements:
 - 1. Refer to Division 00 and Division 01 for general submittal requirements.
 - 2. Requirements set forth in this Section pertain to all specifications included in this Division of work.
- B. Pre-Bid Submittal Requirements
 - 1. Submit Questions and Substitution Requests before the Questions deadline, defined in Division 00 and Division 01.
- C. Bid Submittal Requirements
 - 1. Refer to individual Division sections for specific requirements due with Bid.
- D. Contractor Responsibilities:
 - 1. Provide submittals one time and organized in proper order.
 - 2. Indicate deviations from Drawings and Specifications explicitly in the submittals. Failure to comply will void review automatically.
- E. Submittal Schedule:
 - 1. General:
 - a. Submit a schedule that is coordinated with the project construction schedule.
 - b. Allow for time required for review of submittals, making corrections/revisions to submittals, ordering, manufacturing, fabrication, and delivery.
 - 2. Submittal Schedule to include the following for each submittal as a minimum:
 - a. Identify submittal by specification section number and title.
 - b. Date the item will be submitted. Arrange items in chronological order by scheduled date for first submittal.
 - c. Identify critical submittals and long lead items explicitly.
 - d. Submittal Category:
 - 1) Product Data
 - 2) Coordination Drawings
 - 3) Shop Drawings
 - 4) Samples
 - 5) Construction Sequences
 - 6) Certificates
 - 7) Delegated Design Submittals
 - 8) Test and Evaluation Reports
 - 9) Manufacturers' Instructions
 - 10) Source Quality Control
 - 11) Site Quality Control
 - 12) Manufacturer Reports
 - 13) Sustainable Design
 - 14) Qualification Statements
 - e. Closeout Submittal Category:
 - 1) Maintenance Contracts
 - 2) Operations and Maintenance Data
 - 3) Bonds
 - 4) Warranty Documentation
 - 5) Final Test and Evaluation Reports
 - 6) Record Documentation
 - 7) Demonstration and Training
 - 8) Sustainable Design Closeout

9) Software

- F. Product Data:
1. General:
 - a. Assemble complete submittal package for this Division into a single submittal.
 - 1) Partial submittals will not be accepted.
 - b. Submit product data on following equipment for review:
 - 1) Equipment scheduled on Drawings.
 - 2) Equipment requiring electrical connections or connections by other trades.
 - 3) As required by each specification section or by notes on the Drawings.
 2. Format:
 - a. Electronic: Submit electronic copies for Work of this Division in PDF format.
 - 1) Include a complete index in the original submittal.
 - (a) Incorporate links enabling navigation to each item.
 - (b) Identify with each item filed under a folder and labeled with its respective specification section number, Article, and paragraph.
 - 2) Provide cover sheet for each applicable section number.
 - b. Hard Copy: Submit copies for Work of this Division in a 3-ring loose leaf binder.
 - 1) Include a complete index in the original submittal.
 - (a) Identify with each item filed under a tab and labeled with its respective specification section number, Article, and paragraph
 - 2) Provide cover sheet for each applicable section number.
 3. Include for each item as a minimum:
 - a. Clearly mark and label in each submittal, the piece of equipment provided with the proper nameplate and model number identified.
 - b. Manufacturer's detailed shop drawings including clearances required.
 - c. Manufacturer's detailed specifications.
 - d. Manufacturer's data sheets including capacities, operating speeds, power requirements, design and operating conditions, performance curves, characteristics scheduled or described on the Drawings, and similar data.
 - e. List the name of the motor manufacturer and service factor for each piece of equipment.
 - f. Indicate equipment operating weights including bases and weight distribution at support points.
 - g. Wiring diagrams showing factory installed wiring.
- G. Coordination Drawings:
1. General:
 - a. Assemble complete submittal package for the project into a minimum of two submittals.
 - 1) Coordination Drawings - Below Grade
 - 2) Coordination Drawings - Above Grade
 - b. Prepare project-specific information, drawn accurately to scale.
 - c. Submit coordination drawings for review prior to beginning fabrication.
 - d. Sheet Size: Match sheet size of Construction Drawings.
 - e. Prepare in two-dimensional format utilizing the same digital data software program, version, and operating system utilized to develop the Construction Drawings.
 2. Format:
 - a. Electronic: Submit electronic copies in PDF format.
 - b. Hard Copy: Submit copies in a 3-ring loose leaf binder.

3. Include as a minimum:
 - a. Color code and overlay shop drawings for each trade:
 - 1) Structural
 - 2) Civil
 - 3) Ceiling Systems
 - 4) HVAC Equipment
 - 5) HVAC Ductwork
 - 6) HVAC Piping
 - 7) Plumbing Equipment
 - 8) Plumbing Piping
 - 9) Fire Suppression
 - 10) Lighting
 - 11) Electrical Power
 - 12) Communications
 - 13) Electronic Safety and Security
 - b. Complete floor plans to a minimum of 1/4-inch equals 1-foot scale.
 - c. Mechanical rooms to a minimum of 1/2-inch equals 1-foot scale.
 - d. Sections of congested areas to a minimum of 1/2-inch equals 1-foot scale.
- H. Shop Drawings:
 1. General:
 - a. Assemble complete submittal package for this Division into a single submittal.
 - 1) Partial submittals will not be accepted.
 - b. Prepare project-specific information, drawn accurately to scale.
 - c. Prepare new Shop Drawings by Contractor and not reproductions or tracings of Engineer's Design Drawings.
 - d. Submit shop drawings for review prior to beginning fabrication.
 - 1) Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.
 - e. Sheet Size: Match sheet size of Construction Drawings.
 - f. Prepare in two-dimensional format utilizing the same digital data software program, version, and operating system utilized to develop the Construction Drawings.
 2. Format:
 - a. Electronic: Submit electronic copies for Work of this Division in PDF format.
 - 1) Include a complete index in the original submittal.
 - (a) Incorporate links enabling navigation to each item.
 - (b) Identify with each item filed under a folder and labeled with its respective specification section number, Article and paragraph.
 - b. Hard Copy: Submit copies for Work of this Division in a 3-ring loose leaf binder.
 - 1) Include a complete index in the original submittal.
 - (a) Identify with each item filed under a tab and labeled with its respective specification section number, Article and paragraph.
 3. Include as a minimum:
 - a. Complete floor plans to a minimum of 1/4-inch equals 1-foot scale.
 - b. Mechanical, Electrical, and Technology rooms to a minimum of 1/2-inch equals 1-foot scale.
 - c. Sections of congested areas to a minimum of 1/2-inch equals 1-foot scale.

- d. Fabricated equipment to a minimum of 1/4-inch equals 1-foot scale.
- I. Samples
 - 1. Refer to individual Division sections for Submittal requirements.
- J. Certificates
 - 1. Refer to individual Division sections for Submittal requirements.
- K. Delegated Design Submittals
 - 1. Refer to individual Division sections for Submittal requirements.
- L. Test and Evaluation Reports
 - 1. Refer to individual Division sections for Submittal requirements.
- M. Manufacturers' Instructions
 - 1. Refer to individual Division sections for Submittal requirements.
- N. Source Quality Control Submittals
 - 1. Refer to individual Division sections for Submittal requirements.
- O. Site Quality Control Submittals
 - 1. Refer to individual Division sections for Submittal requirements.
- P. Manufacturer Reports
 - 1. Refer to individual Division sections for Submittal requirements.
- Q. Sustainable Design Submittals
 - 1. Refer to individual Division sections for Submittal requirements.
- R. Qualification Statements
 - 1. Refer to individual Division sections for Submittal requirements.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Contracts
 - 1. Refer to individual Division sections for Submittal requirements.
- B. Operations and Maintenance Data
 - 1. General:
 - a. Assemble complete submittal package for this Division into a single submittal.
 - 1) Partial submittals will not be accepted.
 - b. Submit when the work is substantially complete.
 - c. Submit manufacturer's operation and maintenance instruction manuals and parts lists for review on following equipment:
 - 1) Equipment scheduled on Drawings.
 - 2) Equipment requiring electrical connections or connections by other trades.
 - 3) As required by each specification section or by notes on the Drawings.
 - 2. Format:
 - a. Electronic: Submit electronic copies for Work of this Division in PDF format.
 - 1) Include a complete index in the original submittal.
 - (a) Incorporate links enabling navigation to each item.
 - (b) Identify with each item filed under a folder and labeled with its respective specification section number, Article and paragraph.
 - b. Hard Copy: Submit copies for Work of this Division in a 3-ring loose leaf binder.
 - 1) Include a complete index in the original submittal.
 - (a) Identify with each item filed under a tab and labeled with its respective specification section number, Article and paragraph.
 - 3. Include for each item as a minimum:

- a. Include name and contact information for location of source parts and service for each piece of equipment.
 - b. Clearly mark and label in each submittal, the piece of equipment provided with the proper nameplate and model number identified.
 - c. Manufacturer's operation and maintenance instruction manuals.
 - d. Manufacturer's detailed shop drawings including clearances required.
 - e. Manufacturer's detailed specifications.
 - f. Manufacturer's data sheets including capacities, operating speeds, power requirements, design and operating conditions, performance curves, characteristics scheduled or described on the Drawings, and similar data.
 - g. List the name of the motor manufacturer and service factor for each piece of equipment.
 - h. Indicate equipment operating weights including bases and weight distribution at support points.
 - i. Wiring diagrams showing factory installed wiring.
- C. Bonds
1. Refer to individual Division 00 and Division 01 sections for Submittal requirements.
- D. Warranty Documentation
1. Refer to individual Division 00 and Division 01 sections for Submittal requirements.
- E. Final Test and Evaluation Reports
1. Refer to individual Division sections for Submittal requirements.
- F. Record Documentation
1. Shop Drawings
 - a. Shop drawings updated with as-built information and submitted as the record drawing set.
 2. Record Drawings
 - a. General:
 - 1) Provide drawings with notations reflecting the as-built conditions.
 - 2) Notations to include any additions to or variations from the construction documents provided as part of the BIM coordination, RFIs, ASIs, Owner Changes, and Field Coordination.
 - 3) Prepare project-specific information, drawn accurately to scale.
 - 4) Provide project specific title block.
 - b. Sheet Size: Match sheet size of Construction Drawings.
 - c. Prepare in two-dimensional format utilizing the same digital data software program, version, and operating system utilized to develop the Construction Drawings.
 - d. Format:
 - 1) Electronic: Submit electronic copies of record drawings for Work of this Division in PDF format.
 - (a) Include a complete index in the original submittal.
 - (b) Incorporate links enabling navigation to each item.
 - (c) Identify with each item filed under a folder and labeled with its respective specification section number, Article and paragraph.
 - 2) Hard Copy: Submit copies of record drawings for Work of this Division in a 3-ring loose leaf binder.
 - (a) Include a complete index in the original submittal.

- (b) Identify with each item filed under a tab and labeled with its respective specification section number, Article and paragraph.

- G. Demonstration and Training
1. Training Plan:
 - a. Submit outline of instructional program for demonstration and training.
 - b. Include the following:
 - 1) List of training modules.
 - 2) Schedule of proposed dates, times, length of instruction time.
 - 3) Instructors' names for each training module.
 - 4) Learning objective and outline for each training module.
 2. Training Video Recordings:
 - a. Identification: On each copy, provide an applied label with the following information:
 - 1) Name of Project.
 - 2) Name and address of videographer.
 - 3) Name of Architect.
 - 4) Name of Contractor or Construction Manager.
- H. Sustainable Design Closeout Documentation
1. Refer to individual Division sections for Submittal requirements.
- I. Software
1. Refer to individual Division sections for Submittal requirements.

1.08 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts
1. Refer to individual Division sections for Submittal requirements.
- B. Extra Stock Materials
1. Refer to individual Division sections for Submittal requirements.
- C. Tools
1. Refer to individual Division sections for Submittal requirements.

1.09 QUALITY ASSURANCE

- A. Regulatory Requirements
1. Products and equipment are prohibited from containing pentabrominated, octabrominated and decabrominated diphenyl ethers. Where products or equipment within this specification contain these banned substances, provide complying products and equipment from approved manufacturers with equal performance characteristics.
 2. General:
 - a. Conform Work and materials to requirements of the local, State, and Federal authorities having jurisdiction and other applicable laws and regulations.
 - b. Where codes or standards are referenced, the applicable portions apply.
 - c. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, apply the more stringent.
 - d. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.
 - e. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

- f. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress during the Contractor's working hours. A report will be issued to the Contractor if the field review of the systems construction has revealed elements of the work which are inconsistent with the Contract Documents. All items in the report are to be addressed in writing by the Contractor within two (2) weeks and corrections in the field made as directed.
- B. Apparatus:
 1. Build and install to deliver full rated capacity at the efficiency for which it was designed.
 2. Provide entire system and apparatus that operate at full capacity without objectionable noise or vibration.
- C. Alignment
- D. Install panels, cabinets, and equipment level and true. Provide housekeeping pads and curbs accounting for floor or roof slope.
- E. Install distribution equipment and electrical enclosures fitted neatly, without gaps, openings, or distortion.
 1. Properly and neatly, close unused openings with approved devices.
 2. Fit surface panels, devices, and outlets with neat, appropriate, trims, plates, or covers without overhanging edges, protruding corners, or raw edges.
- F. Materials and Equipment:
 1. Provide new work of good quality, free of faults and defects and in conformance with the Construction documents.
 2. Each piece of equipment furnished will meet the detailed requirements of the Drawings and Specifications and will be suitable for the installation shown. Equipment not meeting the requirements will not be acceptable, even though specified by name along with other manufacturers.
 3. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
 4. Furnish materials and equipment of size, make, type, and quality herein specified.
 5. Equipment scheduled by performance or model number is considered as the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the Contractor is responsible for changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements, or any other differences which impact the project.
- G. Workmanship:
 1. General: Install materials in a neat and professional manner.
 2. Manufacturer's Instructions:
 - a. Follow manufacturer's directions where they cover points not specifically indicated. If they are in conflict with the Drawings and Division Specifications, obtain clarification before starting work.
- H. Noise Control
 1. Do not install contactors, transformers, starters, and similar noise-producing devices on walls that are common to occupied spaces, unless otherwise indicated.
 - a. Where such devices are indicated to be mounted on walls common to occupied spaces, use shock mounts, or otherwise isolate them to prevent the transmission of noise to the occupied spaces.
 2. Ballasts, contactors, starters, transformers, and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.

- I. Cutting and Patching:
 - 1. Provide cutting, patching, and repairing for the proper installation and completion of the work specified in this Division by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work. This work includes but is not limited to plastering, masonry work, concrete work, carpentry work, and painting.
 - 2. Make additional openings required in building construction by drilling or cutting. Use of jackhammer is specifically prohibited.
 - 3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
 - 4. Do not pierce beams, columns or structure members without approval from the Architect and structure engineer, and then only as directed.
 - 5. New or existing work cut or damaged will be restored to its original condition. Where alterations disturb lawns, paving, walks, etc., the surfaces will be repaired, refinished, and left in condition existing prior to commencement of work.

- J. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

- K. Contractor Responsibility:
 - 1. Examination of building and site responsibility:
 - a. Examine site and building prior to installation to determine conditions affecting the scope of work.
 - b. Contact Owner representative for arrangements.
 - 2. Respect and protect the privacy and confidentiality of Owner, its employees, processes, products, and intellectual property to the extent necessary, consistent with the legal responsibilities of the State and Owner policies.
 - 3. Total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications.
 - 4. Specified systems installed under the direction of a qualified Contractor. Qualification requirements include submittal by the Contractor to the Architect of the following:
 - a. Have experience with three or more installations of systems comparable in size, complexity, type, and design as specified herein.
 - b. Perform each of these installations satisfactorily for at least one year after final acceptance by the user. Include the names, locations, and point of contact for these installations as a part of the initial submittal documentation.
 - c. List of previous projects of this scope, size, and nature, including names and sizes of projects, description of work, time of completion, and names of contact persons for reference.

- L. Manufacturers
 - 1. Equipment in these Sections are the standard products of a manufacturer regularly engaged in the manufacture of such products unless specified otherwise. Provide commercial grade components and products used in the system that comply with these Specifications.
 - 2. Each component of equipment identifies the manufacturer's name, model, and applicable serial number. The Owner's authorized representative retains the right to reject products that reflect, in their opinion, sub-standard design practices, manufacturing procedures, support services, or warranty policies.

- M. Certifications
 - 1. Refer to individual Division sections for Submittal requirements.

- N. Sustainability Standards Certifications
 - 1. Refer to individual Division sections for Submittal requirements.

- O. Preconstruction Testing

1. Refer to individual Division sections for Submittal requirements.

P. Site Samples

1. Refer to individual Division sections for Submittal requirements.

Q. Mock-ups

1. Refer to individual Division sections for Submittal requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Assume custody and responsibility for the items upon delivery and determining that the contents are complete and in satisfactory condition for installation.

B. The Contractor is responsible for handling and control of equipment and liable for material loss due to delivery and storage problems.

C. Materials and equipment delivered and placed in storage will be stored with protection from the weather, humidity, and temperature variation, dirt, and dust or other contaminants.

D. Coordinate deliveries and submittals with the General Contractor/Owner to ensure a timely scheduled installation.

E. Equipment and materials are to be delivered to the site no more than three weeks prior to the commencement of its installation. Coordinate with General Contractor/Owner for the location of storage materials.

1.11 SITE CONDITIONS

A. Existing Conditions:

1. Prior to bidding, verify and become familiar with existing conditions by visiting the site.
2. Include related costs associated with site factors in the initial bid proposal.

B. Coordinate exact requirements governed by actual job conditions. Check information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, City, and Utility Company.

1.12 WARRANTY

A. Provide a written guarantee covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.

B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.

C. Arrange to have the equipment factory representative present for those tests where the manufacturer's warranty could be impacted by the absence of a factory representative.

D. Correct warranty items promptly upon notification.

E. Apparatus:

1. Free of defects of material and workmanship and in accord with the Contract Documents.
2. Built and installed to deliver its full rated capacity at the efficiency for which it was designed.

1.13 UNINTERRUPTED SERVICE

A. Maintain electrical, signal and communication services to all functioning portions of the building throughout construction.

- B. Pre-arrange with Owner outages necessary for new construction.
 - 1. Comply with Division 01, General Requirements.
 - 2. Apply for scheduled shutdowns a minimum of 4 weeks prior to time needed and reconfirm a minimum of 72 hours prior to time needed.
 - 3. Contractor is liable for any damages resulting from unscheduled outages or for those not confined to the pre-arranged times. Damages include costs incurred by the Owner and by the Owner's tenants.

1.14 DEMOLITION AND SALVAGE

- A. General:
 - 1. Where affected by work, remove or relocate equipment, services, and systems encountered during the course of the remodel/construction work to a safe location that will be undisrupted by further construction.
 - 2. Disconnect electrical service to hard-wired equipment scheduled for removal under other Divisions of Work.
 - 3. Wiring which serves usable existing outlets restored and routed clear of the construction or demolition.
 - 4. Safely cut off and terminate wiring abandoned and removed to leave site clean.
- B. Reuse of Existing:
 - 1. Existing concealed conduits in good condition may be reused for installation of new wiring where available.
 - 2. Existing undamaged, properly supported surface conduits may be reused where surface conduits are called for, if the installation meets all workmanship requirements of the Specifications.
 - 3. Where new wiring is added or existing wiring disturbed in existing branch circuit raceways, existing wires replaced with new.
- C. Salvage and Disposal:
 - 1. Removed materials, not containing hazardous waste, not scheduled for reuse are the property of the Contractor for removal from the site, except for those items specifically indicated on the Drawings for salvage or reuse.
 - 2. Identify materials containing, or possibly containing, hazardous waste for removal and disposal by the Hazardous Waste Contractor.
 - 3. Neatly store salvaged items at one location at the site where directed by the Owner's Representative.
 - 4. Salvage properly operating circuit breakers from panels scheduled for removal and use to replace faulty or inadequate breakers in existing panels scheduled to remain.

1.15 COMPLETION AND TESTING

- A. General:
 - 1. Comply with Division 01, General Requirements.
- B. Upon completion, test systems to show that installed equipment operates as designed and specified, free of faults and unintentional grounds.
 - 1. Schedule system tests so that several occur on the same day.
 - 2. Coordinate testing schedule with construction phasing.
 - 3. Conduct tests in the presence of the Architect or its representative.
 - 4. Notify Architect of tests 48 hours in advance.
- C. Engage a journeyman electrician with required tools to conduct equipment tests. Arrange to have the equipment factory representative present for those tests where the manufacturer's warranty could be impacted by the absence of a factory representative.
- D. Perform tests per the requirements of each of the following systems:
 - 1. Medium Voltage Distribution System
 - 2. Low Voltage Distribution System

3. Emergency Power System
4. Standby Power System
5. Fire Alarm System
6. Security System
7. Public Address System
8. Nurse Call System
9. Lighting System
10. Lighting Control System
11. Power Metering and Monitoring System
12. Power Factor Correction Capacitors
13. UPS System

- E. Provide a written record of performance tests and submit with operation and maintenance data.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 INSTALLATION

- A. Equipment Support
1. Minimum Support Capacity:
 - a. Provide fastening devices and supports for electrical equipment, luminaires, panels, outlets, and cabinets capable of supporting not less than four times the ultimate weight of the object or objects fastened to or suspended from the building structure.
 2. Powder actuated or similar shot-in fastening devices will not be permitted for any electrical work except by special permission from the Architect.
- B. Equipment Connections
1. General:
 - a. Provide complete electrical connections for all items of equipment requiring such connections, including incidental wiring, materials, devices, and labor necessary for a finished working installation.
 - b. Verify the location and method for connecting to each item of equipment prior to roughing-in.
 - c. Check the amperage, maximum overcurrent protection, voltage, phase, and similar attributes of each item of equipment before rough in and connection.
 2. Motor Connections:
 - a. Make motor connections for the proper direction of rotation.
 - b. Minimum Size Flex for Mechanical Equipment: 1/2-inch; except at small control devices where 3/8-inch flex may be used.
 - c. Exposed Motor Wiring: Jacketed metallic flex with minimum 6-inches slack loop.
 - d. Do not test run pump motors until liquid is in the system.
 3. Control devices and wiring relating to the HVAC systems are furnished and installed under Division 23, HVAC; except for provisions or items indicated in Division 26, Electrical Drawings and Specifications.
- C. Special Techniques
1. Installation in Rated Construction
 - a. Install intumescent material around ducts, conduits, and other electrical elements penetrating rated construction.

- b. Comply with firestop materials manufacturer written instructions to prevent spread of smoke or fire through sleeves or block-outs penetrating rated fire barriers.
- c. Provide firestop materials specified in Division 07, and as follows:
 - 1) Capable of passing a 3-hour test per ASTM E-814 (UL 1479).
 - 2) Consisting of material capable of expanding nominally eight times when exposed to temperatures of 250 degrees F-350 degrees F.
 - 3) An alternate method utilizing intumescent materials in caulk or putty complying with Division 07, Thermal and Moisture Protection Section, "Through-Penetration Firestop Systems" may be used.
- 2. Wiring in Precast Construction
 - a. Coordinate installation of electrical conduit, boxes, fittings, anchors, and miscellaneous items concealed in precast concrete assemblies with the General Contractor.
 - b. Where electrical items are required to be installed in concrete assemblies precast off-site, it will be the Electrical Contractor's responsibility to place the electrical items necessary in the concrete at the off-site locations or pay for the General Contractor to make arrangements for the installation of these items in the precast assemblies. Electrical Contractor held responsible for the proper placement and locations of electrical items at the off-site location.
- D. Interface with Other Work
 - 1. Existing concrete, block, or brick walls are considered not accessible and may require use of Surface Mounted Raceway (SMR) if existing concealed raceway and device boxes are not available for reuse or do not meet the intent of the design (i.e., proximity to egress path, point of use, etc.). Coordinate route and installation where SMR is required with the Architect/Engineer prior to rough-in. Responsible for reinstalling SMR routed without such prior approval to the Architect's satisfaction.
 - 2. Existing stud walls (wood or metal) with or without blocking with plaster, plasterboard, or paneling finish are considered accessible with accessible ceiling, attic, tunnel, or crawl space above, below, or adjacent. Remove, patch, and repair finished surface as required to conceal rough in for new device locations. If it is determined that a specific instance will not permit concealment of rough-in due to obstructions such as beams, headers, and other structural elements, prior approval before rough-in from the Architect is required.
- E. Systems Integration
- F. Tolerances

3.02 SITE QUALITY CONTROL

- A. Site Tests and Inspections
- B. Non-Conforming Work
- C. Manufacturer Services

3.03 CLEANING

- A. Waste Management
- B. General
- C. Painted Surfaces:
 - 1. Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

3.04 PROTECTION

- A. Protect electrical work and equipment installed under this Division against damage by other trades, weather conditions, or any other causes.
 - 1. Equipment found damaged or in other than new condition will be rejected as defective.
- B. Keep switchgear, transformers, panels, luminaires, and electrical equipment covered or closed to exclude dust, dirt, and splashes of plaster, cement, paint, or other construction material spray.
 - 1. Equipment not free of contamination is not acceptable.
- C. Provide enclosures and trims in new condition, free of rust, scratches, and other finish defects.
 - 1. If damaged, properly refinish in a manner acceptable to the Architect.

END OF SECTION

**SECTION 26 05 10
ELECTRICAL BASIC MATERIALS AND METHODS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Building Wire and Cable.
- B. Grounding and Bonding.
- C. Hangers and Supports.
- D. Conduit.
- E. Boxes.
- F. Identification for Electrical Systems.
- G. Equipment Wiring.
- H. Enclosed Switches.

PART 2 - PRODUCTS

2.01 BUILDING WIRE AND CABLE

- A. Conductor And Cable Applications.
 - 1. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
 - 2. Nonmetallic-sheathed cable is permitted only as follows:
 - a. Where not otherwise restricted, may be used:
 - 1) For branch circuit wiring in dry locations and where protected from damage within multifamily dwellings of Types III, IV, and V construction.
 - b. In addition to other applicable restrictions, may not be used:
 - 1) Where exposed to view.
 - 2) Where exposed to damage.
 - 3) For damp, wet, or corrosive locations.
 - 3. Service entrance cable is permitted only as follows:
 - a. Where not otherwise restricted, may be used:
 - 1) For unit feeders in dry and protected locations within multifamily dwellings of Types III, IV, and V construction.
 - b. In addition to other applicable restrictions, may not be used:
 - 1) Where exposed to damage.
 - 2) House panel feeders.
 - 4. Metal-clad cable is permitted only as follows:
 - a. Where not otherwise restricted, may be used:
 - 1) Where concealed in hollow stud walls, above accessible and non-accessible ceilings, and under raised floors for branch circuits and feeders.
 - b. In addition to other applicable restrictions, may not be used:
 - 1) Where not approved for use by the authority having jurisdiction.
 - 2) Where exposed to view, except in dedicated electrical, communications, and mechanical rooms where not subject to damage.
 - 3) Where exposed to damage.
 - 4) For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
 - 5) For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.
- 5. Conductor Material:

- a. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution.
 - 1) Substitution of aluminum conductors for copper is permitted for the following:
 - (a) Services: Copper conductors size 1 AWG and larger.
 - (b) Feeders: Copper conductors size 2 AWG and larger.
 - (c) Branch circuits feeding ranges.
6. Minimum Conductor Size:
 - a. Branch Circuits: 12 AWG.
 - 1) Exceptions:
 - (a) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - (b) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - (c) 15 Amp, 120 Volt Dishwasher and Disposal circuits and other apartment unit wiring where code compliant may be #14 AWG.
 - b. Control Circuits: 14 AWG.
- B. Single Conductor Building Wire.
 1. Conductor Stranding:
 - a. Feeders and Branch Circuits:
 - 1) Size 10 AWG and Smaller: Solid or stranded.
 - 2) Size 8 AWG and Larger: Stranded.
 - b. Control Circuits: Stranded.
 2. Insulation:
 - a. Copper Building Wire: Type THHN/THWN, THHN/THWN-2, or XHHW-2, except as indicated below.
 - 1) Size 4 AWG and Larger: Type XHHW-2, THHN/THWN, or THHN/THWN-2.
 - 2) Installed Underground: Type XHHW-2, THHN/THWN, or THHN/THWN-2.
 - b. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2 or RHH/RHW-2.
- C. Nonmetallic-Sheathed Cable.
 1. Manufacturers:
 - a. Cerro Wire LLC: www.cerrowire.com.
 - b. Encore Wire Corporation: www.encorewire.com.
 - c. Southwire Company: www.southwire.com.
 - d. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
 2. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.
 3. Conductor Stranding:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- D. Service Entrance Cable.
 1. Service Entrance Cable for Above-Ground Use: NFPA 70, Type SE multiple-conductor cable listed and labeled as complying with UL 854, Style R. 75° C rated.
 2. Conductor Stranding: Stranded.
- E. Metal-Clad Cable.
 1. 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.
 2. Conductor Stranding:

- a. Size 10 AWG and Smaller: Solid or stranded.
- b. Size 8 AWG and Larger: Stranded.
3. Insulation: Type THHN/THWN-2 or XHHW-2.
4. Armor: Aluminum or steel, interlocked tape.
- F. Wiring Connectors.
 1. Connectors for Aluminum Conductors: Use compression connectors or mechanical connectors.
 2. Wiring Connectors for Terminations:
 - a. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - b. 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.
 - c. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 - d. Copper Conductors Size 8 AWG and Larger: Use compression connectors where connectors are required OR for all connections.
 - e. Aluminum Conductors Size 1/0 and larger: Use compression connectors where connectors are required. Use oxide inhibiting compound.
 - f. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 - g. Conductors for Control Circuits: Use crimped terminals where connectors are required.
 3. Push-in wire connectors are acceptable as a substitute for twist-on insulated spring connectors.

2.02 INSTALLATION

- A. Include circuit lengths required to install connected devices within 10 ft of location shown.
- B. Circuiting Adjustments: Unless otherwise indicated, when branch circuits that originate in the same panelboard are shown as separate, combining them together in a single raceway is permitted, under the following conditions:
 1. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 2. Increase size of conductors as required to account for ampacity derating.
 3. Size raceways, boxes, etc. to accommodate conductors.
- C. 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.
- D. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.
- E. 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.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- J. 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.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- K. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- L. 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.
- M. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels. Do not attach cables to slack wires. Plastic cable ties shall be plenum rated in plenum spaces.
- N. Conceal all wiring unless specifically indicated to be exposed.

2.03 GROUNDING AND BONDING

- A. Grounding And Bonding Requirements.
 1. 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.
 2. Grounding Electrode System:
 - a. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - 1) Provide continuous grounding electrode conductors without splice or joint.
 - 2) Install grounding electrode conductors in non-metallic raceway where exposed to physical damage.
 - b. Metal Underground Water Pipe(s):
 - 1) Provide connection to underground metal domestic and fire protection (where present) water service pipe(s).
 - 2) Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

- 3) Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
- c. Metal Building or Structure Frame:
 - 1) Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
- d. Concrete-Encased Electrode:
 - 1) Provide connection to concrete-encased electrode consisting of not less than 20 feet of 3/0 bare copper conductor embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
3. Bonding and Equipment Grounding:
 - a. 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.
 - b. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 - c. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 - d. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - e. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 - f. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 - g. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - 1) Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - 2) Metal gas piping.
 - h. Provide bonding for interior metal air ducts.
 - i. Provide bonding for metal building frame where not used as a grounding electrode.
 - j. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
4. Communications Systems Grounding and Bonding:
 - a. 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.
- B. Grounding and Bonding Components.
 1. Conductors for Grounding and Bonding:
 - a. Use insulated copper conductors unless otherwise indicated.
 - 1) Exceptions:
 - (a) Use bare copper conductors where installed underground in direct contact with earth.
 - (b) Use bare copper conductors where directly encased in concrete (not in raceway).

- b. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.
2. Connectors for Grounding and Bonding:
 - a. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 - b. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - c. Unless otherwise indicated, use mechanical connectors or exothermic welded connections for accessible connections.
 - 1) Exceptions:
 - (a) Use exothermic welded connections for connections to metal building frame.
3. Ground Rod Electrodes:
 - a. Comply with NEMA GR 1.
 - b. Material: Copper-bonded (copper-clad) steel.
 - c. Size: 5/8 inch diameter by 10 feet length, unless otherwise indicated.
4. Make grounding and bonding connections using specified connectors.
 - a. 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.
 - b. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - c. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - d. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

2.04 HANGERS AND SUPPORTS

A. Materials

1. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
2. Supports: Fabricated of structural steel or formed steel members; galvanized.
3. Anchors and Fasteners:
 - a. Obtain permission from Architect before using powder-actuated anchors.
 - b. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
 - c. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
 - d. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
 - e. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
 - f. Solid Masonry Walls: Use expansion anchors or preset inserts.
 - g. Sheet Metal: Use sheet metal screws.
 - h. Wood Elements: Use wood screws.
4. Fastener Types:
 - a. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - b. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - c. Concrete Screw Type Anchors: Complying with ICC-ES AC193.

- d. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
- e. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
- f. Other Types: As required.
- g. Manufacturers:
 - 1) Powers Fasteners, Inc.: www.powers.com.
 - 2) Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
- 5. Formed Steel Channel:
 - a. Manufacturer: Kindorf, Unistrut, B-Line, or approved.
 - b. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
- 6. Steel Spring Clips:
 - a. Manufacturer: Caddy, Raco, T&B, B-Line.
 - b. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
- B. Installation
 - 1. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
 - a. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 - b. Obtain permission from Architect before drilling or cutting structural members.
 - 2. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
 - 3. Install surface-mounted cabinets and panelboards with minimum of four anchors.
 - 4. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
 - 5. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

2.05 CONDUIT

- A. Conduit Size: Comply with NFPA 70.
 - 1. Minimum Size: 1/2 inch unless otherwise specified.
 - 2. Telecommunications Systems Cabling Conduit Minimum Size: 1 inch for Cat 5e cable.
- B. Underground Installations:
 - 1. In or Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit, or Schedule 40 thickwall non-metallic conduit.
 - 2. Minimum Size: 3/4 inch unless otherwise specified.
 - 3. Telecommunications Systems Cabling Conduit Minimum Size: 3/4 inch. Confirm cable fill with manufacturer.
- C. Outdoor Locations Above Grade: Use rigid steel conduit or intermediate metal conduit.
- D. In Slab Above Grade:
 - 1. Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing, electrical non-metallic tubing, or Schedule 40 thickwall nonmetallic conduit.
 - 2. Minimum Size Conduit in Slab: 3/4 inch unless otherwise specified. Conduits shall not cross in slab.
 - 3. Telecommunications Systems Cabling Conduit Minimum Size: 3/4 inch. Confirm cable fill with manufacturer.
- E. Wet and Damp Locations: Use rigid steel conduit, intermediate metal conduit, or Schedule 40 thickwall nonmetallic conduit.

- F. Dry Locations:
 - 1. Concealed: Use rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
 - 2. Exposed where not subject to damage: Use rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
 - 3. Exposed where subject to damage: Use rigid steel conduit or intermediate metal conduit.
- G. Maximum conduit fill for telecommunications systems cabling shall not exceed 40 percent.
- H. Verify routing and termination locations of conduit prior to rough-in.
- I. Installation:
 - 1. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.
 - 2. Arrange supports to prevent misalignment during wiring installation.
 - 3. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
 - 4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 - 5. Arrange conduit to maintain headroom and present neat appearance.
 - 6. Route all above grade conduit parallel and perpendicular to walls.
 - 7. Route conduit in and under slab from point-to-point.
 - 8. Do not cross conduits in slab.
 - 9. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F. Maintain 12 inch clearance between non-metallic conduit with low voltage cable and power conductors.
 - 10. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
 - 11. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch size.
 - 12. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
 - 13. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
 - 14. Provide suitable pull string in each empty conduit except sleeves and nipples.
 - 15. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
 - 16. Flexible metal conduit will be permitted only where flexibility is necessary and approved by the Architect. Exceptions are connection to recessed light fixtures. Flexible metal conduit shall be used for connection to all equipment subject to movement or vibration such as motors, transformers, etc. Liquid-tight flexible metal conduit shall be used when moisture may be present and for exposed motor and equipment connection.
 - 17. Conduit runs shall not exceed 100 feet without an accessible pull box installed in line.
 - 18. Communications system conduit run above the ceiling shall not be installed within 12 inches of a parallel run of current carrying conductors, transformers, feeder cables, motors, or lighting ballasts.
 - 19. Conceal all conduit unless specifically allowed to be exposed.

2.06 BOXES

- A. Outlet Boxes.
 - 1. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - a. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.

- b. Concrete Ceiling or Wall Boxes: Concrete type.
 - c. 4" square or round equivalent.
 2. Nonmetallic Outlet Boxes: NEMA OS 2. may be used in apartment units only.
 3. Cast Boxes: NEMA FB 1, Type FD, cast ferrous alloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.
 4. Electrical Outlet Box Pad:
 - a. Electrical outlet box acoustic pads shall be applied as noted. Its function is to seal box openings, increase mass, and provide damping to reduce air-transmitted sound through party walls. It shall consist of polybutene-butyl and inert fillers. Material shall provide good adhesion to metal and plastic. Pads shall be applied to the backs of installed electrical boxes, molded to box, and folded around conduit cable entering the box. Pads shall not be used in areas subject to temperatures above 200 degrees F.
 - b. Install pads at all back-to-back boxes in acoustic rated walls that are closer than 4" to each other.
 - c. Install acoustic sealant at all boxes and associated wiring penetrations for any back-to-back boxes in acoustic rated walls that are closer than 24" to each other. Apply sealant so opening is air tight. This requirement is for all box materials.
 - d. If distance is greater than 24" between back-to-back boxes, neither putty pads or acoustic sealant is required.
 5. Ceiling fan boxes shall be metallic 3/0 type or ceiling fan rated non-metallic boxes.
 6. Box Connectors:
 - a. NM Cables: plastic snap type clamps properly sized for the cable.
 - b. SE/SER Cables: two screw Romex type or SE cable clamps.
 - c. MC Cables: two screw or snap in fittings with code approved cable bushings.
- B. Pull and Junction Boxes.
 1. Sheet Metal Boxes: NEMA OS 1, galvanized steel with screw-on covers.
 - a. Boxes 100 Cubic Inches or Smaller: Standard outlet box with stamped knockouts.
 - b. Boxes 150 Cubic Inches or Larger: Code gauge steel with sides formed and welded, with screw covers unless shown to have hinged doors. Hinged doors shall have locking device same as furnished for panelboards. Knockouts shall be factory stamped or formed in the field with a cutting tool to provide clean symmetrically cut hole.
 2. Fiberglass Handholes: Die molded glass fiber hand holes:
 - a. Cable Entrance: Pre-cut 6 x 6 inch cable entrance at center bottom of each side.
 - b. Cover: Glass fiber weatherproof cover with nonskid finish.
- C. Installation.
 1. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and as required by NEPA 70
 2. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
 3. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
 4. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
 5. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

6. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
7. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
8. Use flush mounting outlet box in finished areas.
9. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
10. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation and not in the same stud cavity.
 - a. Provide minimum 24 inches separation in acoustic rated walls.
 - b. Provide minimum 24 inches separation in fire rated walls.
 - c. Acoustic rated walls:
 - 1) In addition to fire rating requirements, putty packs for acoustical purposes shall be installed at all outlet boxes where installed in common walls between units, floor/ceiling assemblies in units (except PT slab and roof), and at common walls between units and trash rooms and units and stairwells.
11. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
12. Use stamped steel bridges to fasten flush mounting outlet box between studs.
13. Use adjustable steel channel fasteners for hung ceiling outlet box.
14. Do not fasten boxes to ceiling support wires.
15. Use multi-gang box where more than one device is mounted together. Do not use sectional box.

2.07 IDENTIFICATION FOR ELECTRICAL SYSTEMS

- A. Nameplates and Labels.
 1. Nameplates: Engraved three-layer laminated plastic, white letters on black background.
 2. Locations:
 - a. Each electrical distribution and control equipment enclosure.
 - b. Communication cabinets.
 - c. Relays, contactors, starters.
 - d. Remote control devices, such as exhaust fan control switches.
 3. Labels: Embossed adhesive tape, with 3/16 inch black letters on clear background. Use only for identification of individual wall switches and receptacles, and control device stations.
- B. Wire Markers.
 1. Description: Tape type wire markers.
 2. Locations: Each conductor at panelboards, and each load connection.
 3. Legend:
 - a. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - b. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.
- C. Underground Warning Tape.
 1. Description: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.
- D. Installation.
 1. Secure nameplates to equipment front using screws or rivets.
 2. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

3. Identify each end of spare conduit with destination. For trenches over 18" wide, install markers such that they are not over 10 inches apart (edge to edge) over the entire width of the trench.
4. Identify underground conduits using underground warning tape. Install one tape per trench at 6 inches below finished grade.

2.08 EQUIPMENT WIRING

A. Administrative Requirements.

1. Coordination:
 - a. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections or furnished by Owner.
 - b. Determine connection locations and requirements for each item of equipment prior to roughing in. Check the voltage and phase of each item of equipment before connecting. Motor connections shall be made for the proper direction of rotation. Exposed motor wiring shall be jacketed liquidtight metallic flex.
 - c. Conduit, wire and circuit breaker sizes for mechanical equipment and equipment furnished under other Divisions are based on the equipment ratings of one manufacturer. The equipment actually furnished may have different electrical characteristics. Conduit, wire, and circuit breakers shall not be ordered or installed until exact electrical requirements are obtained. Responsibility for this coordination shall rest with the Contractor.
 - d. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering devices and coverplates.
2. Sequencing:
 - a. Install rough-in of electrical connections before installation of equipment is required.
 - b. Make electrical connections before required start-up of equipment.

B. Installation

1. Make electrical connections in accordance with equipment manufacturer's instructions.
2. Make conduit connections to equipment using minimum 1/2 inch flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
3. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
4. Provide receptacle outlet to accommodate connection with attachment plug.
5. Provide cord and cap where field-supplied attachment plug is required.
6. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
7. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
8. Install terminal block jumpers to complete equipment wiring requirements.
9. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

2.09 ENCLOSED SWITCHES

A. Manufacturers

1. Fusible/Nonfusible Switches:
 - a. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
 - b. General Electric Company: www.geindustrial.com.
 - c. Schneider Electric; Square D Products: www.schneider-electric.us.

- d. Siemens: www.sea.siemens.com.
- 2. Elevator Power Module Switch (EPMS):
 - a. Cooper Bussman: www.cooperbussmann.com.
 - b. Littelfuse: www.littelfuse.com.
- B. Components
 - 1. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
 - a. Handle lockable in OFF position.
 - b. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.
 - 2. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
 - a. Handle lockable in OFF position.
 - 3. Enclosures: NEMA KS 1.
 - a. Interior Dry Locations: Type 1.
 - b. Exterior Locations: Type 3R.
 - 4. Elevator Power Module Switch (EPMS):
 - a. Provide elevator power module switch as shown on the drawings.
 - b. The EPMS shall be constructed, certified, and listed to the following standards: NFPA 70, ANSI/ASME, NFPA 72.
- C. Installation.
 - 1. Furnish and install an enclosed switch at each motor and resistance heating equipment location.

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 26 05 19**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Single conductor building wire.
- B. Underground feeder and branch-circuit cable.
- C. Armored cable.
- D. Metal-clad cable.
- E. Power and control tray cable.
- F. Conductors - Fire Pump Circuits
- G. Wiring connectors.
- H. Oxide inhibiting compound.
- I. Wire pulling lubricant.
- J. Cable ties.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation.
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers.
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation.
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- I. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable.
- J. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC).
- K. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF).

- L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
- M. NFPA 70 - National Electrical Code.
- N. UL 4 - Armored Cable.
- O. UL 44 - Thermoset-Insulated Wires and Cables.
- P. UL 83 - Thermoplastic-Insulated Wires and Cables.
- Q. UL 486A-486B - Wire Connectors.
- R. UL 486C - Splicing Wire Connectors.
- S. UL 486D - Sealed Wire Connector Systems.
- T. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables.
- U. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
- V. UL 854 - Service-Entrance Cables.
- W. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
- X. UL 1569 - Metal-Clad Cables.

1.04 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.

1.05 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittal procedures.
- B. 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.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 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.

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. Conductor Material:
 - 1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
 - 4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- H. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - 3. Color Code:
 - a. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
 - a. General
 - b. Essex
 - c. Okonite
 - d. Cerro Wire LLC.
 - e. Encore Wire Corporation.
 - f. General Cable Technologies Corporation.
 - g. Southwire Company.
- 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.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

- A. Manufacturers:
 1. Cerro Wire LLC.
 2. Encore Wire Corporation.
 3. Southwire Company.
 4. Okonite
- B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
- C. Provide equipment grounding conductor unless otherwise indicated.
- D. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
- E. Insulation Voltage Rating: 600 V.

2.05 SERVICE ENTRANCE CABLE

- A. Manufacturers:
 1. Copper Service Entrance Cable:
 - a. Cerro Wire LLC.
 - b. Encore Wire Corporation.
 - c. Southwire Company.
 - d. Okonite
- B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.
- C. Conductor Stranding: Stranded.
- D. Insulation Voltage Rating: 600 V.

2.06 ARMORED CABLE

- A. Manufacturers:
 1. AFC Cable Systems Inc.
 2. Encore Wire Corporation.
 3. Southwire Company.
- B. 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.
- 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.

- F. Grounding: Combination of interlocking armor and integral bonding wire.
- G. Armor: Steel, interlocked tape.

2.07 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc.
 - 2. Encore Wire Corporation.
 - 3. Southwire Company.
 - 4. Okonite .
- 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.

2.08 POWER AND CONTROL TRAY CABLE

- A. Manufacturers:
 - 1. Encore Wire Corporation.
 - 2. General Cable Technologies Corporation.
 - 3. Okonite.
 - 4. Southwire Company.
- B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.
- C. Conductor Stranding: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type XHHW or XHHW-2.
- F. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.09 CONDUCTORS - FIRE PUMP CIRCUITS

- A. RHH Mineral insulated cable, factory assembly of one or more conductors.
- B. Insulated with highly compacted magnesium oxide insulation and enclosed in a seamless, liquid and gas tight continuous copper sheath.
- C. Solid, high conductivity copper with a cross sectional area corresponding to standard sizes.
- D. Insulation Thickness: Minimum of 55 mil fo cable sizes 14 AWG to 250 MCM.
- E. Cable Assembly: UL listing and rating for two hours fire resistive rating.
- F. System fitting listed and identified for fire rated cable usage.

2.10 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 05 26.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
 - 3. Connectors for Aluminum Conductors: Use compression connectors.
- 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. Aluminum Conductors: Use compression connectors for all connections.
 - 7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 - 8. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. 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.
 - b. Ideal Industries, Inc.
 - c. NSI Industries LLC.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. IIsco.
 - c. Thomas & Betts Corporation.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. IIsco.
 - c. Thomas & Betts Corporation.

- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. IlSCO.
 - c. Thomas & Betts Corporation.

2.11 ACCESSORIES

- A. Electrical Tape:
 - 1. Manufacturers:
 - a. 3M.
 - b. Plymouth Rubber Europa.
 - 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.
- B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. Ideal Industries, Inc.
 - c. IlSCO.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
 - 1. Manufacturers:
 - a. 3M.
 - b. American Polywater Corporation.
 - c. Ideal Industries, Inc.
- D. Cable Ties: Material and tensile strength rating suitable for application.
 - 1. Manufacturers:
 - a. Burndy LLC.

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.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 FIRE PUMP CIRCUITS

- A. At each location where the fire pump circuit passes through a fire rated wall or floor assembly, provide a conduit seal at the nearest practicable location to the fire rated wall or floor. The conduit at the seal and within 25-feet on either side, either IMC or GRC with threaded connectors and couplings.
- B. Encase fire pump feeders in a minimum of 3-inches of concrete, routed underground or beneath a concrete slab or use a fire rated mineral insulated cable approved for fire pump feeders.

3.04 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
 - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
 - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.
- F. Install armored cable (Type AC) in accordance with NECA 120.
- G. Install metal-clad cable (Type MC) in accordance with NECA 120.
- 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. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

- J. 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.
- K. 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.
- L. Install conductors with a minimum of 12 inches of slack at each outlet.
- M. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- N. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- O. 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 contaminants. Do not use wire brush on plated connector surfaces.
 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- P. 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.
- Q. Insulate ends of spare conductors using vinyl insulating electrical tape.
- R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 05 26

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.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
 - 1. Includes oxide inhibiting compound.
- B. Section 26 05 53 - Identification for Electrical Systems:
- C. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.
- E. NFPA 70 - National Electrical Code.
- F. NFPA 99 - Health Care Facilities Code.
- G. UL 467 - Grounding and Bonding Equipment.

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. For signal reference grids, coordinate the work with access flooring furnished in accordance with Section 09 69 00.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, 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. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

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. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet 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.
 - b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
 - c. Provide ground enhancement material around conductor where indicated.
 - d. Provide connection from ground ring conductor to:
 - 1) Perimeter columns of metal building frame.
 - 2) Ground rod electrodes located as indicated.
 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.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 - d. Provide ground enhancement material around electrode where indicated.
 - e. Provide ground access well for each 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 2 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.
 9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
 2. Provide equipment grounding conductor routed with supply conductors.
 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- I. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Generators, when neutral is switched in the transfer switch.
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
 5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
 6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- J. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 - c. Metal process piping.
 8. Provide bonding for interior metal air ducts.
 9. Provide bonding for metal building frame.
 10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
 11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
 12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.
- K. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
 2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
 3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.
- L. 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 2 by 12 inches unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- M. Signal Reference Grids:
1. Provide signal reference grid on subfloor under access floors where indicated.
 2. Construct grid using field-welded sections of pre-fabricated signal reference grids.

3. Unless otherwise indicated, locate grid between 6 and 18 inches (150 and 450 mm) from perimeter walls.
4. Unless otherwise indicated, make bonding connections to signal reference grid using exothermic welded connections.
5. Make bonding connections as short as possible, with no sharp folds or bends.
6. Unless otherwise indicated, provide separate bonding connections from signal reference grid to each item to be bonded. Do not daisy chain items together to facilitate single point connection to signal reference grid.
7. Provide 6 AWG bonding jumper to connect every sixth access floor pedestal in each direction to signal reference grid. Make connections to floor pedestals using exothermic welded connections.
8. Provide 6 AWG bonding jumper to connect each steel column within and at the perimeter of room to signal reference grid. Make connections to steel columns using exothermic welded connections.
9. Provide 6 AWG bonding jumper to connect each metal item such as conduits, pipes, ducts, etc. crossing the plane of, or within 6 feet (1.8 m) of, the signal reference grid. Make connections to conduits and pipes using listed ground clamps.
10. Provide 6 AWG bonding jumper to connect signal reference grid to grounding point of separately derived systems serving equipment located on the signal reference grid.
11. Provide low impedance risers to connect each equipment enclosure to signal reference grid. For each piece of equipment, provide two separate connections of different lengths connected to opposite sides of equipment and to different points on the signal reference grid. Make connections to equipment enclosures using mechanical connectors. Do not make connection to signal reference grid on the outermost grid conductor.
12. Provide transient suppression plates on floor beneath items indicated. Provide 6 AWG bonding jumper to connect transient suppression plate to signal reference grid.
 - a. Transient Suppression Plates: Constructed from 26 gauge sheet copper, 4 by 4 feet unless otherwise indicated.

N. Pole-Mounted Luminaires: Also comply with Section 26 56 00.

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 05 26:

1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - a. Exceptions:
 - 1) Use mechanical connectors for connections to electrodes at ground access wells.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
 4. Manufacturers - Mechanical and Compression Connectors:
 - a. Advanced Lightning Technology (ALT).
 - b. Burndy LLC.
 - c. Harger Lightning & Grounding.
 - d. Thomas & Betts Corporation.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC.
 - b. Cadweld, a brand of Erico International Corporation.
 - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC.
 - d. Substitutions: See Section 01 60 00 - 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.
 4. Manufacturers:
 - a. Advanced Lightning Technology (ALT).
 - b. Erico International Corporation.
 - c. Harger Lightning & Grounding.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- 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.
 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
 5. Manufacturers:
 - a. Advanced Lightning Technology (ALT).
 - b. Erico International Corporation.
 - c. Galvan Industries, Inc.
 - d. Harger Lightning & Grounding.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
 2. Resistivity: Not more than 20 ohm-cm in final installed form.
 3. Manufacturers:
 - a. Erico International Corporation.
 - b. Harger Lightning & Grounding.
 - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Pre-Fabricated Signal Reference Grids:
1. Description: Factory pre-fabricated grid manufactured from 2 inch wide, 26 gauge, flat copper strips spaced on 24 inch centers, factory-welded at each crossover.

2. Low Impedance Risers: Factory fabricated 2 inch wide, 26 gauge, flat copper strips designed for connecting equipment enclosures to pre-fabricated signal reference grid.
 3. Manufacturers:
 - a. Advanced Lightning Technology (ALT).
 - b. Erico International Corporation.
 - c. Harger Lightning & Grounding.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Oxide Inhibiting Compound: Comply with Section 26 05 19.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
 2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
- D. Make grounding and bonding connections using specified connectors.
 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 05 53.
- F. Ufer Ground: Provide a concrete encased building grounding electrode where shown on the Drawings. Grounding electrode to consist of a minimum of 20 feet of #4 AWG copper conductor cast into the bottom 6 inches of an exterior concrete foundation or footing.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 05 29

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 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- D. Section 26 05 36 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.
- E. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- F. Section 26 25 13 - Low-Voltage Busways: Additional support and attachment requirements for busway.
- G. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- H. Section 26 56 00 - 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.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- D. MFMA-4 - Metal Framing Standards Publication.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- F. NFPA 70 - National Electrical Code.
- G. UL 5B - Strut-Type Channel Raceways and Fittings.

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 30 00.

1.05 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. 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.
- E. Installer's Qualification Statement: Include evidence of compliance with specified requirements.
- F. 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 NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.
- 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 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. 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. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 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 50 00.
- C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
 3. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation.
 - b. Erico International Corporation.
 - c. O-Z/Gedney, a brand of Emerson Electric Co.
 - d. Thomas & Betts Corporation.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
 1. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation.
 - b. Erico International Corporation.
 - c. O-Z/Gedney, a brand of Emerson Electric Co.
 - d. Thomas & Betts Corporation.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 1. Comply with MFMA-4.
 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
 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 width by 13/16 inch height.
 6. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation.
 - b. Thomas & Betts Corporation.
 - c. Unistrut, a brand of Atkore International Inc.

- d. Substitutions: See Section 01 60 00 - Product Requirements.
 - e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- G. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber 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.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
 4. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation.
 - b. Erico International Corporation.
 - c. PHP Systems/Design.
 - d. Unistrut, a brand of Atkore International Inc.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the 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.
 11. Hammer-driven anchors and fasteners are not permitted.
 12. 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.
 13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
 14. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc.
 - b. ITW Red Head, a division of Illinois Tool Works, Inc.
 - c. Powers Fasteners, Inc.
 - d. Simpson Strong-Tie Company Inc.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 15. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Hilti, Inc.
 - b. ITW Ramset, a division of Illinois Tool Works, Inc.
 - c. Powers Fasteners, Inc.

- d. Simpson Strong-Tie Company Inc.
- e. Substitutions: See Section 01 60 00 - Product Requirements.

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. Perform work in accordance with NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Field-Welding (where approved by Architect): Comply with Section 05 50 00.
- I. 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 30 00.
 - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- J. Conduit Support and Attachment: Also comply with Section 26 05 33.13.
- K. Cable Tray Support and Attachment: Also comply with Section 26 05 36.
- L. Box Support and Attachment: Also comply with Section 26 05 33.16.
- M. Busway Support and Attachment: Also comply with Section 26 25 13.
- N. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.
- O. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00.
- P. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- Q. Secure fasteners according to manufacturer's recommended torque settings.

- R. Remove temporary supports.
- S. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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

SECTION 26 05 33.13

CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Intermediate metal conduit (IMC).
- D. PVC-coated galvanized steel rigid metal conduit (RMC).
- E. Flexible metal conduit (FMC).
- F. Liquidtight flexible metal conduit (LFMC).
- G. Electrical metallic tubing (EMT).
- H. Rigid polyvinyl chloride (PVC) conduit.
- I. Reinforced thermosetting resin conduit (RTRC).
- J. Conduit fittings.
- K. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 84 00 - Firestopping.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
- H. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC).
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S).
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A).
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC).
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT).

- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC).
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
- J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.
- L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
- M. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series.
- N. NFPA 70 - National Electrical Code.
- O. UL 1 - Flexible Metal Conduit.
- P. UL 6 - Electrical Rigid Metal Conduit-Steel.
- Q. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel.
- R. UL 360 - Liquid-Tight Flexible Steel Conduit.
- S. UL 514B - Conduit, Tubing, and Cable Fittings.
- T. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
- U. UL 797 - Electrical Metallic Tubing-Steel.
- V. UL 1242 - Electrical Intermediate Metal Conduit-Steel.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Architect of any 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 is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
 - 1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
 - 2. 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. 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 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 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
 - 6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use PVC-coated galvanized steel rigid metal conduit.
 - 7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- D. Embedded Within Concrete:
 - 1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 2. Within Slab Above Ground: Not permitted.
 - 3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).

4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.
 5. Where electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or 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 communications rooms or closets.
 - b. Where exposed below 20 feet in warehouse areas.
- K. Exposed, Exterior: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit or MC cable whip.
1. Maximum Length: 6 feet.
- N. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit or liquidtight flexible metal conduit.
 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 3. Maximum Length: 6 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.

2.02 CONDUIT REQUIREMENTS

- A. 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 a mandrel through them.
- B. Electrical Service Conduits: Also comply with Section 26 21 00.
- C. Communications Systems Conduits: Also comply with this Section.
- D. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.
- E. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

- F. Provide products listed, classified, and labeled as suitable for the purpose intended.
- G. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 - 3. Control Circuits: 3/4 inch (21 mm) trade size.
 - 4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
 - 5. Underground, Interior: 3/4 inch (21 mm) trade size.
 - 6. Underground, Exterior: 3/4 inch (21 mm) trade size.
- H. 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.
 - 2. Republic Conduit.
 - 3. Wheatland Tube Company.
- 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.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation.
 - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - 4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit.
 - 2. Republic Conduit.
 - 3. Wheatland Tube Company.
- B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation.
 - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use aluminum.
 - 4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit.

2. Republic Conduit.
 3. Wheatland Tube Company.
- 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. Manufacturers:
 - a. Bridgeport Fittings Inc.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation.
 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
1. Thomas & Betts Corporation.
 2. Robroy Industries.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.
- D. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
- E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.07 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
1. AFC Cable Systems, Inc.
 2. Electri-Flex Company.
 3. International Metal Hose.
- 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 to be used.
- C. Fittings:
1. Manufacturers:
 - a. Bridgeport Fittings Inc.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:

1. AFC Cable Systems, Inc.
 2. Electri-Flex Company.
 3. International Metal Hose.
- 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 Inc.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation.
 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 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
1. Allied Tube & Conduit.
 2. Republic Conduit.
 3. Wheatland Tube Company.
- B. Description: NFPA 70, Type EMT 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 Inc.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 5. Use in dry protected locations for circuits rated 600V and less. Exceptions:
 - a. EMT is acceptable for outdoor use in photovoltaic roof applications.
 - b. EMT is acceptable for other outdoor applications in covered locations.
 - c. For outdoor applications, raintight fittings must be used.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
1. Cantex Inc.
 2. Carlon, a brand of Thomas & Betts Corporation.
 3. JM Eagle.
- 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.

2.11 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

- A. Manufacturers:
 - 1. Champion Fiberglass, Inc.
 - 2. FRE Composites.
 - 3. United Fiberglass of America, Inc.
- B. Applications:
- C. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
- D. Supports: Per manufacturer's recommendations.
- E. Fittings: Same type and manufacturer as conduit to be connected.

2.12 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- E. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

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.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. 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 all 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 conduits exposed:
 - 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 the shortest possible manner unless otherwise indicated. Route all 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 the 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 the same area together on a common rack.
- I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide required vibration isolation and/or seismic controls in accordance with Section 26 05 48.
 3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 4. 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.
 5. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
 9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
 10. Use of spring steel conduit clips for support of conduits is permitted only as follows:
 - a. Support of electrical metallic tubing (EMT) up to 1 inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
 11. Use of wire for support of conduits is permitted only as follows:
 - a. For securing conduits to studs in hollow stud walls.
 - b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).

12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.
- J. 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. 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 a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
 7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- K. 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. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 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, using materials and methods specified in Section 07 84 00.
- L. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 23 16.13.
 2. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length for service entrance where not concrete-encased.
- M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
 2. Maximum Conduit Size: 3/4 inch (21 mm) unless otherwise approved.
 3. Minimum Conduit Spacing: 2 inch.
 4. Install conduits within middle one third of slab thickness.
 5. Secure conduits to prevent floating or movement during pouring of concrete.
- N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.
- O. 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 calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
 4. Where conduits are subject to earth movement by settlement or frost.
- P. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- Q. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- R. Provide grounding and bonding in accordance with Section 26 05 26.
- S. Identify conduits in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 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

SECTION 26 05 33.16

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. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.13 - Conduit for Electrical Systems:
 - 1. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 27 26 - Wiring Devices:
 - 1. Wall plates.
 - 2. Additional requirements for locating boxes for wiring devices.
- G. Section 27 10 00 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
- G. NFPA 70 - National Electrical Code.
- H. SCTE 77 - Specification for Underground Enclosure Integrity.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.
- K. UL 508A - Industrial Control Panels.

- L. UL 514A - Metallic Outlet Boxes.
- M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.

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 minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
 - 1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.
- C. Samples:
 - 1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.
- 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. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - 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.

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 iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
 5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
 6. Use suitable concrete type boxes where flush-mounted in concrete.
 7. Use suitable masonry type boxes where flush-mounted in masonry walls.
 8. Use raised covers suitable for the type of wall construction and device configuration where required.
 9. Use shallow boxes where required by the type of wall construction.
 10. Do not use "through-wall" boxes designed for access from both sides of wall.
 11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
 14. 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.
 15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 16. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
 17. Wall Plates: Comply with Section 26 27 26.
 18. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation.
 - b. Hubbell Incorporated; Bell Products.
 - c. Hubbell Incorporated; RACO Products.
 - d. O-Z/Gedney, a brand of Emerson Electric Co.

- e. Thomas & Betts Corporation.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- C. 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 screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or 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.
 - c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
 - 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
 - 6. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation.
 - b. Hoffman, a brand of Pentair Technical Products.
 - c. Hubbell Incorporated; Wiegmann Products.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. 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.
- 1. Manufacturers:
 - a. Hubbell Incorporated.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
- 1. Manufacturers:
 - a. Quickflash Weatherproofing Products, Inc:

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. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 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 27 26.
 - b. Communications Systems Outlets: Comply with Section 27 10 00.
 - 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 05 33.13.
 - 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.
- I. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

- 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch 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.
- L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- M. Install boxes as required to preserve insulation integrity.
- N. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- Q. Close unused box openings.
- R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- S. Provide grounding and bonding in accordance with Section 26 05 26.
- T. Identify boxes in accordance with Section 26 05 53.

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 05 45

SEISMIC RESTRAINTS FOR ELECTRICAL RACEWAYS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Seismic Bracing
 - 2. Channel Type Elements
 - 3. Bolting Accessories

1.02 RELATED SECTIONS

- A. Division 01, General Requirements
- B. Division 26, Electrical
- C. Section 26 05 29, Hangers and Supports for Electrical Systems

1.03 REFERENCED STANDARDS

- A. The following are the referenced standards:
 - 1. Sheet Metal and Air Conditioning Contractor's National Association
 - 2. American Institute of Steel Construction
 - 3. American Society for Testing and Materials
 - 4. American Welding Society
 - 5. International Building Code
 - 6. International Code Council
 - 7. Office of Statewide Health Planning and Development

1.04 QUALITY ASSURANCE

- A. General Requirements:
 - 1. Provide seismic restraints for equipment, both supported and suspended, conduits, and cable tray systems.
 - 2. Bracing of conduits and cable trays in accordance with the provisions set forth in the SMACNA seismic restraint manual and the requirements set in ASCE 7-10 Section 13.2.
 - 3. Review and approve structural requirements for restraints, including their attachment to the building structure by a registered structural engineer in the same state as the project.
 - 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.
- B. Bracing of Conduits:
 - 1. Provide seismic bracing of conduit as detailed below:
 - 2. Exception: Conduits suspended by individual hangers 12-inches or less in length, as measured from the top of the conduit to the bottom of the support where the hanger is attached, need not be braced.
 - a. Brace electrical conduits 2-1/2 inch nominal diameter or larger.
 - b. Brace conduits located in electrical rooms, boiler rooms, mechanical equipment rooms, and refrigeration mechanical rooms that are 1-1/4-inch nominal diameter and larger.
- C. Suspended Equipment and Raceways:
 - 1. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable with an added nut and neoprene and steel washer.

2. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and are to be indicated in the shop drawings.
 3. Provide detailed shop drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.
- D. Seismic restraints, including anchors to building structure, designed by a registered professional structural engineer licensed in the state of Oregon. Design includes:
1. Number, size, capacity, and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. For units weighing greater than 2500 pounds, or curbs more than 10 feet long, provide substantiating calculations the curb can accept the prescribed seismic forces.
 2. Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations, test data, or California OSHPD approval number verifying the horizontal and vertical ratings of the seismic restraint devices.
 3. Number, size, capacity, and location of braces and anchors for suspended raceways, bus ducts, and cable trays on as-built plan drawings.
 - 1) Select a single seismic restraint system pre-designed to meet the requirements of the latest edition of the IBC such as the 1999 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems.
 - 2) Details or designs from separate seismic restraint guidelines are not acceptable. Installation not addressed by the selected system shall be designed, detailed, and submitted alone with the as-built plan drawings.
 - 3) Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional structural engineer licensed in the state of Oregon who designed the layout of the braces.
- E. Supports, Hangers, and Anchors: Comply with the requirements of Section 26 05 29 - Hangers and Supports for Electrical Systems meet the requirements of ASCE 7-10 Section 13.2 based on the Seismic Design Criteria located on the structural drawings.

1.05 SUBMITTALS

- A. Product Data: Submit product data for products specified herein.
- B. Shop Drawings:
1. Submit shop drawings complying with the requirements of the Quality Assurance article of this Section.
 2. Stamp shop drawings by a professional structural engineer licensed in the state of Oregon.
 3. Approve submittals prior to rack fabrication and installation.
- C. Calculations:
1. Submit seismic calculations indicating restraint loadings resulting from the design seismic forces presented in the Quality Assurance article of this Section.
 2. Include anchorage details that include the diameter, embedment, and material grade of the material in which the anchor is placed.
 3. Stamped by a professional structural engineer licensed in the state of Oregon.
- D. Certifications:
1. Submit certification of seismic restraint's and building structural member's capability to safely accept loads resulting from seismic forces calculated in the previous paragraph.

2. Tests in three planes clearly showing ultimate strength and appropriate safety factors performed by independent laboratories and certified by a professional structural engineer licensed in the state of Oregon or calculations by a professional structural engineer licensed in the state of Oregon are acceptable.

PART 2 PRODUCTS

2.01 SEISMIC BRACING:

- A. Steel fabrication, in accordance with AISC Steel Manual, with structural steel shapes of ASTM A 36 steel.
- B. Welding in accordance with AWS D1.1.
- C. Design and sizes as required.
- D. Fastenings, bracing, and assembly selected by a professional structural engineer licensed in the state of Oregon.
- E. Show that the maximum stress in any structural steel member will not exceed 18,000 psi.

2.02 CHANNEL TYPE ELEMENTS

- A. 12 gauge formed steel, 1-5/8-inch square prime painted or chromate dip finish. Use spring-in nuts with grooves.

2.03 BOLTING ACCESSORIES

- A. Machine bolts with semi-finished nuts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide support assemblies to meet the seismic zone indicated. Equipment shall be braced and anchored to conform to the requirements listed under the Quality Assurance article of this Section.
- B. Seismically brace raceways, cable trays, and suspended bus duct to conform to the requirements listed under the Quality Assurance article of this Section.
- C. Provide pipeline seismic flexible connectors where piping crosses building earthquake joints. Arrange raceways and connectors for the amount of motion required. Maintain continuity of the grounding system for each of the joints.
- D. Do not use powder-actuated inserts.
- E. Seismic Restraints:
 1. Attach to structural members of the building, which are capable of withstanding the design load of the seismic restraint.
 2. Ensure load capacity of the structural members is greater than or equal to the capacity of the seismic restraint.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting.
- B. Section 09 91 23 - Interior Painting.
- C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 26 05 36 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
- E. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.
- F. Section 26 23 00 - Low-Voltage Switchgear: Factory-installed mimic bus.
- G. Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
- H. Section 26 31 00 - Photovoltaic Collectors: Additional identification requirements for photovoltaic systems.
- I. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.
- C. NFPA 70 - National Electrical Code.
- D. UL 969 - Marking and Labeling Systems.

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 26 05 00 - Common Work Results for Electrical, for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Samples:
 1. Identification Nameplates: One of each type and color specified.
 2. Warning Signs and Labels: One of each type and legend specified.
- 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.

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. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchgear:
 - 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 identification nameplate to identify main and tie devices.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
 - 6) See Section 26 23 00 for factory-installed mimic bus.
 - b. Switchboards:
 - 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 identification nameplate to identify main overcurrent protective device.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

- c. 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) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
- d. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
- e. Electricity Meters:
 - 1) Identify load(s) metered.
- 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
- 3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
 - c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
- 4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
- 5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
- 6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
- 7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
- 8. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.
- 9. Use identification label on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
- 10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

11. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
 - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
 12. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
 13. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
 14. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
 15. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
 16. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
 17. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
 2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.
 3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
 4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
 - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
 - d. In cable tray, at maximum intervals of 20 feet.
 5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
 6. Use underground warning tape to identify direct buried cables.
- D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
 2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.

- a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
 - 1) Color Code:
 - (a) Emergency Power System: Red.
 - (b) Fire Alarm System: Red.
 - 2) Field-Painting: Comply with Section 09 91 23 and 09 91 13.
 - 3) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
 3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
 4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
 5. Use underground warning tape to identify underground raceways.
 6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.
- E. Identification for Cable Tray: Comply with Section 26 05 36.
- F. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
 2. Use voltage markers or color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-painted in accordance with Section 09 91 23 and 09 91 13 per the same color code used for raceways.
 - b. For exposed boxes in public areas, do not color code.
 3. Use handwritten text using indelible marker to identify circuits enclosed.
 - a. For exposed boxes in public areas, provide identification on inside face of cover.
 4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
- G. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 10 00.
 2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
 3. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.
 4. Use identification label to identify fire alarm system devices.
 - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
 5. Use identification label to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
 6. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
 7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.
- H. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.
- I. Identification for Photovoltaic Systems: Comply with Section 26 31 00

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
1. Manufacturers:
 - a. Brady.
 - b. 3M.
 - c. Brimar Industries, Inc.
 - d. Kolbi Pipe Marker Co.
 - e. Seton Identification Products.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
 4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Manufacturers:
 - a. 3M.
 - b. Brady Corporation.
 - c. Brother International Corporation.
 - d. Panduit Corp.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend:
 - a. System designation where applicable:
 - 1) Emergency Power System: Identify with text "EMERGENCY".
 - 2) Fire Alarm System: Identify with text "FIRE ALARM".
 - b. Equipment designation or other approved description.
 - c. Other information as indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. System Designation: 1 inch.
 - b. Equipment Designation: 1/2 inch.
 - c. Other Information: 1/4 inch.

- d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
 - a. Normal Power System: White text on black background.
 - b. Emergency Power System: White text on red background.
 - c. Fire Alarm System: White text on red background.
- D. Format for General Information and Operating Instructions:
 1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/4 inch.
 5. Color: Black text on white background unless otherwise indicated.
 - a. Exceptions:
 - 1) Provide white text on red background for general information or operational instructions for emergency systems.
 - 2) Provide white text on red background for general information or operational instructions for fire alarm systems.
- E. Format for Caution and Warning Messages:
 1. Minimum Size: 2 inches by 4 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/2 inch.
 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Power source and circuit number or other designation indicated.
 - a. Include voltage and phase for other than 120 V, single phase circuits.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on clear background.
- G. Format for Control Device Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Load controlled or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on clear background.
- H. Format for Fire Alarm Device Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Designation indicated and device zone or address.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

- A. Manufacturers:
 1. 3M.
 2. Brady Corporation.
 3. HellermannTyton.
 4. Panduit Corp.

5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
 1. Do not use handwritten text.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

- A. Manufacturers:
 1. 3M.
 2. Brady Corporation.
 3. Brimar Industries, Inc.
 4. Seton Identification Products.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Minimum Size:
 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
 3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
 4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- C. Legend:
 1. Markers for Voltage Identification: Highest voltage present.
 2. Markers for System Identification:
 - a. Emergency Power System: Text "EMERGENCY".
 - b. Other Systems: Type of service.
- D. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 1. Brady Corporation.
 2. Brimar Industries, Inc.
 3. Seton Identification Products.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
 1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.

- F. Color:
 - 1. Tape for Buried Power Lines: Black text on red background.
 - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 FLOOR MARKING TAPE

- A. Manufacturers:
 - 1. 3M.
 - 2. Brady Corporation.
 - 3. Brimar Industries, Inc.
 - 4. Seton Identification Products.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

- A. Manufacturers:
 - 1. Brimar Industries, Inc.
 - 2. Clarion Safety Systems, LLC.
 - 3. Seton Identification Products.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
 - 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- D. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - a. Do not use labels designed to be completed using handwritten text.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 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. Conduits: Legible from the floor.
 8. Boxes: Outside face of cover.
 9. Conductors and Cables: Legible from the point of access.
 10. 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.
1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 05 80
ELECTRICAL TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes:
1. Testing Equipment

1.02 RELATED SECTIONS

- A. Division 01, General Requirements
B. Division 26, Electrical
C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables
D. Section 26 05 26 - Grounding and Bonding for Electrical Systems
E. Section 26 09 43 - Network Lighting Controls
F. Section 26 24 13 - Switchboards
G. Section 26 27 13 - Electricity Metering
H. Section 26 24 16 - Panelboards
I. Section 26 32 13 - Engine Generators
J. Section 26 33 23 - Central Battery Equipment
K. Section 26 33 53 - Static Uninterruptible Power Supply
L. Section 28 46 00 - Fire Detection and Alarm

1.03 TESTING CRITERIA

- A. General:
1. Perform field tests and operational checks to assure that all electrical equipment, both contractor and Owner supplied, is operational within industry and manufacturer's tolerances, and is installed in accordance with design specifications.
2. The tests and operational check shall determine the suitability for energization.
3. Schedule tests and give a minimum of one week's advance notice of time and date to the Architect and Owner for any major systems tests specified in this Section.
4. The testing company shall provide the equipment and technical personnel to perform all tests and inspections. At Contractors expense, furnish any personnel necessary to assist in the testing and inspection.
5. When tests and inspections are complete, attach a label to the devices tested. Provide on the label, the name of the testing company, date of tests, and initials of the Engineer who performed the tests.
- B. Responsibilities:
1. Clean the equipment, torque down accessible bolts according to the equipment manufacturer's instructions; perform routine insulation resistance tests on branch and feeder circuits, continuity checks on branch and control wiring, and rotation tests for distribution and utilization equipment.

2. Furnish a complete set of current plans and specifications to the testing company prior to commencement of testing. At each test site, provide test control power necessary to perform the tests specified. Consult the test organization as to the specific power requirements. Notify the testing organization when the equipment and systems are ready for their inspections and testing. After review by the testing engineer, correct deficiencies noted by the testing company.
 3. Responsible for having the manufacturer of each equipment and/or system provide factory trained representatives(s) that will perform required functional testing, checkout, and repairs in order to pronounce the equipment and/or systems meet the requirements of these specifications and Drawings and it is ready for startup testing and commissioning by the testing organization as specified hereafter.
 4. Furnish settings of protective devices by the Engineer, in conjunction with Utility.
 5. Testing organization to notify Engineer prior to the commencement of testing. The testing organization, set, and adjust the protective devices and associated auxiliary timing devices in accordance with the values furnished by the Engineer. The testing organization maintains a written record of tests and, upon completion of the test, include them in a final report. Detail deficiencies in the system material, workmanship, or design.
- C. Implementation:
1. Safety practices comply with applicable state and local safety orders, as well as with the Occupational Safety and Health Act (OSHA). Compliance with the National Fire Protection Association (NFPA) standard NFPA 70E, and the Accident Prevention Manual for Industrial Operations of the National Safety Council.
 2. Tests, other than phase rotation and operational tests, only performed on apparatus that is deenergized. The testing company's lead test engineer for the project designated safety representative and supervise testing observations and safety requirements. Do not proceed with Work until determined that it is safe to do so.
 3. Power Circuits: Conductors shorted to ground by a hotline grounding device approved for the purpose. Provide warning signs and protective barriers as necessary to conduct the tests safely.
- D. Reports:
1. General: Provide full documentation of tests in the form of a report.
 2. Test report includes the following sections:
 - a. Scope of Testing
 - b. Equipment Tested
 - c. Description of Test
 - d. Test Results
 - e. Conclusions and Recommendations
 - f. Appendix, including Test Forms
 3. Record each piece of equipment on a data sheet listing the condition of the equipment as found and as left. Include recommendations for necessary repair and/or replacement parts. Indicate on data sheets the name of the engineer who tested the equipment and the date of the test completion.
 4. Submit record copies of the completed test report no more than 30 days after completion of the testing and inspection.

1.04 REFERENCES

- A. The testing and inspection comply with applicable sections of the applicable codes and standards listed in Section 26 05 00 - Common Work Results for Electrical of the project specifications.
- B. The inspection and testing comply with the project plans and specifications, as well as with the manufacturer's drawings, instruction manuals, and other applicable data that may be provided by the Engineer, for the apparatus tested.

1.05 QUALIFICATIONS

- A. Testing Organization:
1. Independent division of the manufacturer of the assembled products being tested. If an outside testing organization is utilized, a representative of the manufacturer under contract by the testing company. Be present during testing to ensure the testing is performed properly and deficiencies discovered are promptly corrected.
 2. Full Service Company that employs factory trained test engineers capable of troubleshooting, as well as identifying power equipment problems.
 3. Perform Work outlined under the full time, onsite supervision of a graduate engineer with a minimum of 5 years of field testing experience.
 4. Upon request, submit proof of its qualifications.

PART 2 PRODUCTS

2.01 TESTING EQUIPMENT

- A. Testing agency to have calibration program, which maintains applicable test instrumentation within rated accuracy. Traceable accuracy to the National Bureau of Standards in an unbroken chain. Calibrate instruments calibrated in accordance with the following frequency schedule:
1. Field Instruments: 6 month maximum.
 2. Laboratory Instruments: 12 months.
 3. Leased Specialty Equipment: 12 months (where accuracy is guaranteed by lessor). Dated calibration labels visible on test equipment.

PART 3 EXECUTION

3.01 EQUIPMENT TO BE TESTED

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables:
1. For circuits rated 400A or higher perform tests listed in the NETA 2017 Acceptance Testing Specifications for Low-Voltage Cables, Section 7.3.2.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems :
1. Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Grounding Systems, Section 7.13.
- C. Section 26 24 13 - Switchboards:
1. Switchboards: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Switchgear and Switchboard Assemblies, Section 7.1.
 2. Circuit Breakers: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Low-Voltage Circuit Breakers, Section 7.6.1.1.
- D. Section 26 24 16 - Panelboards:
1. Panelboards: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Switchgear and Switchboard Assemblies, Section 7.1. Only those tests applicable to panelboards need be performed, no electrical tests of the circuit breakers need to be performed.
- E. Section 26 27 13 - Electricity Metering:
1. Instrument Transformers: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Instrument Transformers, Section 7.10.
 2. Metering Functions: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Metering, Section 7.11.
- F. Section 28 46 00 - Fire Detection and Alarm:

1. Fire Alarm System: Perform tests listed in Section 28 46 00 - Fire Detection and Alarm .

END OF SECTION

SECTION 26 08 00

COMMISSIONING FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

- A. The commissioning process is described in Section 01 91 13 - General Commissioning Requirements.
- B. Provide all labor and materials required to complete the commissioning of those Division 26, Electrical, systems and equipment identified as Commissioned Systems and Equipment in Section 01 91 13 - General Commissioning Requirements.

1.02 RELATED SECTIONS INCLUDE:

- A. Division 01, General Requirements
- B. Division 26, Electrical
- C. Section 01 91 13 - General Commissioning Requirements.

1.03 SUBMITTALS

- A. Refer to 01 91 13 - General Commissioning Requirements.

1.04 COMMISSIONING SCOPE OF WORK - COMMISSIONING AGENT

- A. Refer to 01 91 13 - General Commissioning Requirements.

1.05 COMMISSIONING SCOPE OF WORK - CONTRACTOR

- A. Refer to 01 91 13 - General Commissioning Requirements.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Refer to 01 91 13 - General Commissioning Requirements.

PART 3 EXECUTION

3.01 MEETINGS

- A. Refer to Section 01 91 13 - General Commissioning Requirements.

3.02 INSTALLATION, CHECK-OUT, START-UP AND PREFUNCTIONAL CHECKS

- A. Refer to 01 91 13 - General Commissioning Requirements.

3.03 FUNCTIONAL TESTING

- A. Refer to 01 91 13 - General Commissioning Requirements.

3.04 TRAINING OF FACILITY OPERATING STAFF AND BUILDING OCCUPANTS

- A. Refer to Section 01 91 13 - General Commissioning Requirements.

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Control Stations.
- B. Standalone Room Controllers.
- C. Occupancy/Vacancy Sensors.
- D. Photosensor.
- E. Relays, Switchpacks, and Room Controllers.
- F. Power Supplies and Transformers.
- G. Emergency Lighting Control Relays.
- H. Low Voltage Control Wiring.
- I. Test Equipment.
 - 1. Responsibilities and participation under Division 26, Electrical in the automatic dimming system installation and commissioning process.
 - 2. Installation, connection, adjustment, and testing of the equipment including labor, materials, tools, appliances,

1.02 GENERAL REQUIREMENTS

- A. Provide qualified personnel for participation in commissioning tests, including seasonal testing required after the initial commissioning.
- B. Providing equipment, materials, and labor necessary to correct deficiencies found during the commission process which fulfill contract and warranty requirements.
- C. Provide Operating and Maintenance Data and Record Drawings to the Test Engineer for verification, organization, and distribution.
- D. Provide assistance to the Test Engineer to develop and edit descriptions of system operation.
- E. Providing training for the systems specified in this Division with coordination by the Test Engineer and Commissioning Agent.

1.03 SUBMITTALS

- A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, installed features, system wiring schematics, and user interface components.
- B. Shop Drawings:
 - 1. Submittal drawings with a complete system diagram to show quantity of devices, location in the building, dimensions and required wiring.
 - 2. Occupancy sensors, show the required quantity to cover the space controlled (note: this may be more than the quantity shown on the drawings).
 - 3. The locations shown on the drawings are for reference only and coordinated with the manufacturer and Architect for final quantity and location during the bid process to allow for allowance of proper quantity, wiring lengths and installation coordination.
- C. Samples:

1. Provide physical samples of user interface devices and visually exposed control devices for approval by Owner and Architect.
- D. Operation and Maintenance Manuals:
 1. Include product data of system components, one line diagrams of installed components and their locations throughout the building, a final floor plan noting the locations of devices installed above ceilings, behind access panels or in concealed but accessible spaces and the lighting zones or devices they control.
 2. Final relay schedule with the zone of control, location of control zone, voltage, power feed, time clock setting, photocell set point, switch, or dimmer stations controlling the relay, and sweep function set points will be provided by the Contractor.
- E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.06 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.07 SYSTEM DESCRIPTION

- A. Control Stations:
 1. Control Station Types:
 - a. Provide control stations for occupant lighting control as scheduled on the drawings and may include and/or combine the following type of individual control type within a single station:
 - 1) Scene Selection
 - 2) On/Off Switching
 - 3) Dimming Raise/Lower
 - 4) Occupancy/Vacancy Sensor
- B. Relays, Switchpacks, and Room Controllers:
 1. Analog and Digital: Room controller devices to accept line voltage input as well as input from any combination of control stations, occupancy/vacancy sensors and/or daylight sensors and produce the required effect (switching or dimming) on up to four zones of connected lighting.
- C. Occupancy/Vacancy Sensing:
 1. Reduce electric energy consumption by reducing or eliminating lighting energy use in unoccupied spaces by switching lighting off with occupancy and/or vacancy sensors.

- D. Photoelectric Daylight Harvesting:
 - 1. Daylit Areas:
 - a. Reduce electric energy consumption during daylight hours by reducing the light output of the electric lighting system via switching in response to measured lighting levels provided by daylight within the building interior.
 - b. Dimming zones will correlate with the distribution of daylight within the space as noted on plans.
- E. Emergence Override: Provide automatic load control relay devices for controlling egress lighting circuiting.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Approved Manufacturers:
 - 1. Cooper Controls
 - 2. Wattstopper
 - 3. Lutron
 - 4. Acuity Controls (nLight, LC&D, Sensor Switch)
 - 5. PLC Multipoint
 - 6. Hubbell
 - 7. Encelium
- B. Products described in this section are to be provided by the single BOD (basis of design) or approved alternate manufacturer listed above, or by a compatible, BOD approved third party alternate manufacturer.
 - 1. Manufacturer series numbers are identified herein to establish the minimum level of quality for each product.
 - 2. Comparable products that meet the requirements of the specification by other acceptable manufacturers identified herein are acceptable with prior approval.
 - 3. Other or equivalent Manufacturers and Products: Submit Substitution Request, complying with requirements.

2.02 CONTROL STATIONS

- A. Control Station Types:
 - 1. Scene Select: Provide five scene selection control station including discrete, engraveable pushbuttons allowing on/off and raise/lower control of entire space and means for occupants to select from five scenes.
 - 2. On/Off:
 - a. Provide individual pushbuttons.
 - b. Controls lighting in entire space if no zones indicated on plans.
 - 3. Dimming/Raise Lower:
 - a. Provide individual pushbuttons for on and off control of zones indicated on plans.
 - b. Controls lighting in entire space if no zones indicated on plans.
 - c. Dimming accomplished by separate up and down pushbuttons.
 - 4. Integral Occupancy:
 - a. Automatically switches lighting on when occupant enters space.
 - b. Switches lights off after predetermined period of vacancy.
 - c. Controls lighting in entire space.
 - 5. Integral Vacancy:
 - a. Includes pushbuttons for occupant manual on/off and dimming control of lighting in space.
 - b. Automatically switches lights off after predetermined period of vacancy.

- c. Includes provision to revert to occupancy control in absence of configurable amount of daylight.
 - d. Controls lighting in entire space.
- B. Line Voltage Dimming Switches:
- 1. Architectural grade, line voltage, 20A rated, single pole, preset style, slide up to brighten and down to dim, with on/off rocker style switch, decora style, wattage rating and lamp/power supply compatibility as required.
 - 2. Forward Phase, Reverse Phase, 0-10V.
 - 3. Provide 3-way type where shown on plan.
 - 4. Lutron Diva Series
- C. Wallbox Occupancy Sensor Switches:
- 1. 180 degree coverage, type as shown on plan (PIR, ultrasonic or dual-technology), configurable automatic-on or manual on operation, 3-wire type, daylight override, adjustable time-out, selectable walk-through mode and override off switch. Single or dual relay type as required or as shown on Drawings.
 - 2. Provide 3-way type where shown on plan.
 - 3. WattStopper PW series.
- D. Digital Control Stations:
- 1. Provide control stations with configuration as indicated or as required to control the loads as indicated.
 - 2. General Requirements:
 - a. Power: Class 2 (low voltage).
 - b. UL listed.
 - c. Provide faceplates with concealed mounting hardware, with matching finish.
 - d. Borders, logos, and graduations to use laser engraving or silk-screened graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning. Self-Adhesive labels not permitted.
 - e. Finish: As specified for wall controls in this Section.
 - 3. Single-Zone or Single-Group:
 - a. Turn an individual fixture or group of fixtures as shown on plans on and off via button press.
 - b. Raise and lower light levels via press and hold button.
 - 1) Separate buttons for dimming and on/off functions not allowed.
 - 4. Multi-Scene or Multi-Group:
 - a. General Requirements:
 - 1) Allows control of any devices part of the lighting control system as indicated on plans.
 - 2) Controls can be programmed with different functionality through system software without any hardware changes. Allows contextual functions based upon button press and press and hold input.
 - 3) Allows for easy reprogramming without hardware replacement.
 - 4) System will automatically update programming without direct human interaction upon replacement of any component.
 - 5) Communications: Utilize RS485 or similar wiring for low-voltage communication.
 - 6) To help occupants understand how to use the lighting control system, engraving requirements should be included for controls. Engraving details should include text size and style.
 - 7) Engrave keypads with button, zone, and scene descriptions as indicated on the drawings.

- 8) Software Configuration:
 - (a) Single defined action.
 - (b) Buttons can be programmed to perform defined action on press and defined action on release.
 - (c) Buttons can be programmed using conditional logic off of a state variable such as time of day or partition status.
 - (d) Buttons can be programmed to perform automatic sequence of defined actions.
 - (e) Capable of deactivating select keypads to prevent accidental and/or unwanted changes to light levels and other settings.
 - (f) Buttons can be programmed for raise/lower of defined loads.
 - (g) Buttons can be programmed to toggle defined set of loads on/off.
- 9) Status LEDs:
 - (a) Upon button press, LEDs to immediately illuminate.
 - (b) Time delays inherent in large systems can cause short delays between button press and system confirmation. To avoid any confusion and prevent multiple button presses, keypads should immediately show that the button has been pressed for visual confirmation.
 - (c) LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or LEDs to turn off if the button press was not processed.
 - (d) Support logic that defines when LED is illuminated:
 - (e) Scene logic (logic is true when zones are at defined levels).
 - (f) Room logic (logic is true when at least one zone is on).
 - (g) Pathway logic (logic is true when at least one zone is on).
 - (h) Last scene (logic is true when spaces are in defined scenes).
- b. Wired Keypads:
 - 1) Style:
 - (a) Mounting: Wall box or low-voltage mounting bracket; provide wall plates with concealed mounting hardware.
 - 2) Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
 - 3) Terminal block/connector inputs to be over-voltage and miswire-protected against wire reversals and shorts.
 - 4) LEDs next to each button are used during programming and provide feedback when the buttons are pressed.
 - 5) Available with status LEDs.
 - 6) Available in several button configurations and finishes.
 - 7) Four Scene Control:
 - (a) On, four scenes, and off with master raise/lower.
 - (1) Four LEDs for night light and secondary color to indicate programming mode.
 - (2) Recall four scenes plus on or off for one group of fixtures.
 - (3) Master raise/lower control for entire group of fixtures.
 - (4) Immediate local LED response upon button activation to indicate that a system command has been requested.

2.03 STANDALONE ROOM CONTROLLERS

- A. General:
1. Provides a common, standalone interface via dimming and/or switching to a group of 0-10V Dimming or Fixed Output Ballasts and/or 0-10V LED Drivers.
 2. Direct conduit connection or provision for mounting to junction box.
 3. Physical barriers provided between Class 1 and Class 2 wiring as well as between normal power and emergency power wiring.
 4. Dual voltage 120/277V, 60HZ operation, 20A rating for each relay Relays utilize zero crossing technology for increased life.
 5. Plenum Rated.
- B. Digital Room Controllers and Switchpacks:
1. Replacement of any component requires no reconfiguration or reprogramming.
 2. Low voltage connections via CAT5/6 and RJ-45 connectors.
 3. On board power supply for a minimum of six accessory devices including, but not limited to occupancy sensors and control stations.
 4. Up to four on-board relays and accompanying 0-10V dimming channels.
 5. Provision for IR or RF remote for configuration and editing of connected device settings.
 - a. Provide means to copy settings from on system to another.
 6. Field configurable to support, occupancy (automatic on) and vacancy (manual on) control protocol. Daylight harvesting feature for any number of zones.
 7. Timeclock Functionality:
 - a. Provide functionality to directly trigger relay and dimmer settings by timeclock event and:
 - b. Mask or lock out sensor and/or control station inputs by timeclock event.
 8. Room Controller: WattStopper LMRC Series
 9. Switchpack: WattStopper LMZC Series
- C. Analog Room Controllers and Power Packs:
1. On board power supply for a minimum of six accessory devices including, but not limited to occupancy sensors.
 2. Up to four on-board relays and accompanying 0-10V dimming channels.
 3. Provision for IR or RF remote for configuration and editing of connected device settings.
 - a. Provide means to copy settings from on system to another.
 4. Field configurable to support, occupancy (automatic on) and vacancy (manual on) control protocol with optional daylight harvesting feature.

2.04 OCCUPANCY/VACANCY SENSORS

- A. General Requirements:
1. Power Failure Memory: Settings and learned parameters to be saved in non-volatile memory and not lost should power be interrupted and subsequently restored.
 2. Furnished with necessary mounting hardware and instructions.
 3. NEC Class 1 or 2 devices, refer to plans.
 4. Ceiling-Mounted Sensors: Indicate viewing directions on mounting bracket.
 5. Wall-Mounted Sensors: Provide swivel-mount base.
 6. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.
 7. Isolated Relay: Provide ceiling mounted sensors with an internal isolated relay with Normally Open, Normally Closed, and Common outputs rated at 1A at 30VDC/VAC for use with HVAC control, Data Logging and other control options.
 8. Line Voltage sensors accept line voltage input and output switched line voltage directly to controlled luminaires.
 - a. Line voltage sensors must be capable of occupancy or vacancy control.
Operation is to be determined by onboard device settings.

- b. Sensor configuration to be made by integral pushbutton or dial controls.
 - c. Types:
 - 1) PIR: utilize invisible light to determine occupancy.
 - 2) Ultrasonic/Microphonic: utilize audible or subaudible sound to determine occupancy.
 - 3) Dual-Tech: utilize a combination of the above technologies to determine occupancy.
 - (a) Detection of vacancy by both ultrasonic and PIR sensors required to turn lights off.
9. Low Voltage sensors are paired with a switch pack or room controller. Provide digital sensors compatible with room controller/switchpack and balance of system.
- a. Low voltage sensors must be capable of occupancy or vacancy control. Operation is to be determined by overall system configuration and/or device settings.
 - b. Sensor configuration to be made by wireless handheld configuration tool by integral pushbutton.
 - c. Types:
 - 1) PIR: utilize invisible light to determine occupancy.
 - 2) Ultrasonic/Microphonic: Utilize audible or sub-audible sound to determine occupancy.
 - 3) Dual-Tech: Utilize a combination of the above technologies to determine occupancy.
 - (a) Detection of vacancy by both ultrasonic and PIR sensors required to turn lights off.
- B. Ceiling Mounted: 360 degree coverage:
- 1. Automatic-on operation, light-level sensing, adjustable time-out, automatic sensing/adjustment for optimal time-out delay setting, selectable walk-through mode.
 - 2. Low- or line-voltage as shown on Drawings or described in Section 26 09 93 - Sequence of Operations for Lighting Controls,
 - 3. Surface mounted, provide power packs as required.
 - a. Dual Technology Type:
 - 1) Low Voltage: WattStopper DT-300 Series.
 - 2) Line Voltage: WattStopper DT-355 Series
- C. Ceiling/Wall Mounted/Corner: 180 degree coverage:
- 1. Automatic-on operation, light-level sensing, adjustable time-out, automatic sensing/adjustment for optimal time-out delay setting, selectable walk-through mode,
 - 2. Low-voltage with power pack, surface mounted as required.
 - a. Dual Technology type: WattStopper DT-200 series.
- D. Provide multiple contacts and/or power packs for Low Voltage occupancy sensors that:
- 1. Control both normal and emergency lighting and require separation of branch circuit wiring systems. In case of occupancy sensor failure, emergency lighting fail to the on state.
 - 2. Control separate lighting control zones. Unless otherwise noted, occupancy sensors are intended to control light in a designated zone or room. Contractor is responsible for providing the required power packs to insure functionality of the system.
 - 3. Provide UL924 listed relay or power pack for to bypass occupancy sensors in event of power failure. During normal operation, relay to operate lighting in conjunction with adjacent normal power lighting.
- E. Low Temperature/Wet Location Occupancy Sensor: 1. Provide line voltage occupancy sensors where shown on plans.

1. Automatic-on operation, light-level sensing, adjustable time-out, automatic sensing/adjustment for optimal time-out delay setting, selectable walk-through mode.
 2. Temperature Range at least -40 degrees F to +95 degrees F. With a minimum IP 65 rating.
 3. Surface mounted, provide auxiliary contacts if required.
 - a. Passive infrared type: WattStopper CB-100 Series
- F. High Ceiling Occupancy Sensor:
1. Provide low or line voltage occupancy sensors where shown on plans.
 2. Automatic-on or manual-on operation, light-level sensing, adjustable time-out, automatic sensing/adjustment for optimal time-out delay setting, selectable walk-through mode.
 3. Suitable for mounting heights from 12-feet-40-feet.
 4. Surface mounted, provide auxiliary contacts if required.
 - a. Passive infrared type: WattStopper HB Series

2.05 PHOTOSENSOR

- A. General Requirements:
1. Use NEC Class 2 wiring for low voltage communication.
 2. Can be replaced without reprogramming.
 3. Photopically corrected to approximate human vision.
 4. Daylight sensing equipment will be digital, full range type, self or manually calibrated.
 5. Provide proper photocell type(s) as required to:
 - a. Measure lighting levels on an affected interior surface. Illumination contribution to this measured surface will include both daylighting and electric lighting (closed-loop system).
 - b. Measure light levels entering space through glazing. Illumination contribution to this measured surface will include daylighting only (open-loop system).
 - c. Measure light levels on affected interior surface and entering space through glazing. Illumination contribution to these measured surfaces will include both daylight and electric lighting (combination open and closed loop/dual loop system).
 6. Independently control single zone of luminaires for maximum energy savings while maintaining even task illumination across the entire area between zones. Refer to drawings for control groupings.
 7. Incorporate time delay logic to prevent cycling due to clouds and other short-term influences to lighting levels.
 8. Accept indoor, skylight, and outdoor photo sensing heads. Photo sensing control permit the user to specify the actual footcandle level where desired switching occurs.
- B. Indoor:
1. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
 2. Open Loop:
 - a. Adjustable aiming angle to accommodate various glazing configurations
 - b. Provide linear response from 0 to minimum 1000 foot-candles.
 - c. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
 - d. Wattstopper LMLS-500 Series.
 3. Closed Loop:
 - a. Indoor sensors have a Fresnel lens, with a minimum 60 degree cone of response.
 - b. Provide linear response from 0 to minimum 500 foot-candles.
 - c. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.

- d. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
 - e. Wattstopper LMLS-400 Series.
- C. Outdoor / Rooftop:
- 1. Outdoor models have a hood over the aperture to shield the sensor from direct sunlight.
 - 2. The outdoor sensor circuitry completely encased in an optically clear epoxy resin.
 - 3. Range between 0 and 750 FC.
- D. Analog: Interior/Exterior: PLC CES Series

2.06 RELAYS, SWITCHPACKS AND ROOM CONTROLLERS

- A. Analog:
- 1. Devices interconnected via low voltage cabling.
 - 2. Configurable to produce the following sequences of operation by handheld IR or RF remote.
 - a. Occupancy control: Automatically turns lights on when occupant is detected in space. Automatically turns lights off after a configurable period of vacancy.
 - b. Vacancy Control: Occupant must manually turn lights in space on, automatically turns lights off after a configurable period of vacancy.
 - c. Timeclock
 - d. Daylight Harvesting:
 - 1) Occupant must manually turn lights in space on, automatically turns lights off after a configurable period of vacancy.
 - 2) Accepts input from analog daylight sensing equipment and adjusts light level settings accordingly.
- B. Digital:
- 1. Devices interconnected by contractor terminated cabling.
 - 2. Configurable to produce the following sequences of operation by handheld IR or RF remote.
 - a. Occupancy Control:
 - 1) Automatically turns lights on when occupant is detected in space.
 - 2) Automatically turns lights off after a configurable period of vacancy.
 - b. Vacancy Control: Occupant must manually turn lights in space on, automatically turns lights off after a configurable period of vacancy.
 - c. Timeclock
 - d. Daylight Harvesting
 - 1) Occupant must manually turn lights in space on, automatically turns lights off after a set period of vacancy.
 - 2) Accepts input from daylight sensing equipment and adjusts light level settings accordingly.
 - 3. Provides additional capability or accessories to integrate with AV, BAS, HVAC, and/or shade control systems.

2.07 POWER SUPPLIES AND TRANSFORMERS

- A. Provide from same manufacturer of equipment served.
- B. Compatible with specified photocells and dimming control station protocols.
- C. Refer to Section 26 50 00 - Lighting for product specification on luminaire power supplies and transformers.

2.08 EMERGENCY LIGHTING CONTROL RELAYS

- A. Manufacturers:

1. Bodine
 2. Nine 24
 3. Wattstopper
 4. Or approved equivalent.
- B. General Requirements
1. Comply with UL 924 requirements:
 - a. If controlled off, must turn on automatically.
 - b. Provide required egress illuminance along entire egress path.
 - c. Must not be able to be overridden by building occupants.
 2. Unless shown otherwise on drawings, load control relay provided is to control egress lighting along with adjacent normal power lighting except in event of power failure or fire alarm system alarm status.
 3. Device can be integral to other components listed above or operate in conjunction with other lighting control components as a discrete component, but must be fed via UL 1008 compliant power source, such that in event of a power failure, control and dimming signals are bypassed and lighting operates at full power. Fed via the UL 1008 source.
- C. Description:
1. Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts.
 2. UL 924 listed for connected load of 10A at 277V or 120V.
 3. UL rated N.C. contacts, minimum 10A rating.
 4. Integral surge protection.
 5. Two separate status emergency lighting indicators for troubleshooting:
 - a. Amber LED indicates presence of normal utility power.
 - b. Red LED indicates presence of unswitched emergency power.
 6. Manual and/or automatic diagnostic testing feature.
 7. Self-contained enclosure UL listed for installation in indoor or damp locations.

2.09 LOW VOLTAGE CONTROL WIRING

- A. 18 gauge shielded cable or as recommended by the manufacturer.

2.10 TEST EQUIPMENT

- A. Provide multi-function digital illuminance meter with detachable receptor head with the following characteristics:
1. Receptor: Silicon photocell type
 2. Illuminance Units: Lux or footcandles (switchable)
 3. Measuring range: 0.1 to 19,990 lux, 0.01 to 1,999 footcandles
 4. Accuracy: ± 4 percent ± 1 digit of displayed value
 5. Cosine Correction Characteristics: Within ± 1 percent at 10 degrees; within ± 5 percent at 60 degrees.
 6. Measuring functions: Illuminance, integrated illuminance, average illuminance.
 7. Temperature/humidity drift: Within ± 3 percent ± 1 digit (of value displayed at 68 degrees F) within operating temperature/humidity range.
 8. Operating conditions: 32 degrees F to 104 degrees F at less than 85 percent humidity.
- B. Provide proof of calibration within 12 months of use. Calibration performed by an independent calibration lab approved by the manufacturer of the meter.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Submittal data required prior to ordering and installation.

- B. General Testing:
 - 1. Functionally test control devices to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved drawings, specifications, and manufacturers' installation instructions.
 - 2. Prepare and complete report of test procedures and results and file with the Owner.
- 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 27 26.
- G. Provide required supports in accordance with Section 26 05 29.
- 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. Identify lighting control devices in accordance with Section 26 05 53.
- J. Low Voltage Wiring:
 - 1. Install in conduit where running through inaccessible areas. Provide plenum rated wiring in accessible ceiling spaces.
 - 2. Test CAT5/6 cables terminated on site prior to wiring of digital lighting control systems. Provide evidence of successful testing to Engineer and Owner. Factory pre-terminated cabling is not subject to this requirement.
 - 3. Coordinate low voltage wiring connection and location with luminaires to be controlled.
- K. Occupancy Sensors:
 - 1. For installation of low voltage occupancy sensors in inaccessible ceiling systems, coordinate power pack locations with Architect prior to installation and coordinate access panel locations with Architect.
 - 2. Sensor locations identified on Drawings are diagrammatic and are meant to indicate only that occupancy sensing within a given space is required. Locate sensors as required by the manufacturer to provide maximum coverage of the room, to operate as someone enters the room, and to avoid false operation due to persons outside the room passing an open door.
 - a. Provide additional sensing heads as necessary or per manufacturer's recommendation to achieve complete coverage of each room.
 - 3. Set sensitivity as required to provide small movement coverage throughout the room without extending coverage beyond the room.
 - 4. System performance testing done with the sensor timing set to the time delay indicated by space type in Section 26 09 93 - Sequence of Operations for Lighting Controls.
 - 5. Upon Completion of installation and prior to turning space over to Owner, Contractor reset occupancy sensor automatic self-adjustment settings to insure proper time delay self-adjustment for Owner occupant schedule and room use.
 - 6. Allow for up to 24 hours of callback sensor adjustments to be made by the Contractor or occupancy sensor manufacturer qualified installer for up to six months after the Owner has taken occupancy of the space.
- L. Emergency Lighting Control Relays:
 - 1. Provide unswitched emergency circuit, and unswitched and switched normal circuit to UL 924 relay for control of emergency luminaires with remaining room luminaires on normal power.

2. Install each relay within dedicated 4-11/16-inch junction box with double-gang plaster ring for wall or ceiling flush-mount or in a self-contained enclosure from the manufacturer, as indicated on Drawings.
3. Where location in ceiling would interfere with removal of ceiling tiles, install relay flush-mounted in nearest wall at ceiling level.
4. Do not locate behind wall switch.

3.02 WORK PRIOR TO COMMISSIONING

- A. Complete phases of work so the system can be powered, tested, adjusted, and otherwise commissioned. Under Division 26, Electrical, complete systems, including subsystems, so they are fully functional. This includes the complete installation of equipment, materials, wire, controls, etc., in accordance with the contract documents and related directives, clarifications, change orders, etc.
- B. A commissioning plan will be developed by the Test Engineer and approved by the Commissioning Agent. Under Division 26, Electrical, assist the Test Engineer and Commissioning Agent in preparing the commissioning plan by providing necessary information pertaining to the actual equipment and installation. If system modifications and clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner. If Contractor initiated system changes have been made that alter the commissioning process, the Commissioning Agent will notify the Owner.
- C. Specific pre-commissioning responsibilities under Division 26, Electrical are as follows:
 1. Factory startup services for the following items of equipment:
 - a. Lighting Control System
 2. Normal startup services required to bring each system into a fully operational state. This includes complete installation and cleaning. The Test Engineer will not begin the commissioning process until each system is documented as being installed complete.
- D. Begin commissioning after installation of interior and exterior finishes including but not limited to adjacent roofing, finished floor, wall, and ceiling systems including final painting, furniture and book stacks in place, and other building systems which have direct or indirect influence on the performance and distribution of the daylight and electric lighting systems.
- E. Start of commissioning before such items are complete will not relieve Contractor from completing those systems in accordance with the Construction Schedule.

3.03 SEQUENCE OF COMMISSIONING

- A. Provide to Architect prior to start of commissioning layout drawings indicating proposed location of measurement points. Proceed with commissioning after review and acceptance by Architect.
- B. Illuminance measurements oriented horizontal, facing up, at 30-inches above finished floor. Measurements for a control group occurs at the same location. Ensure constancy of local surface reflectance conditions throughout commissioning of each control group.
- C. Ensure no personnel or outside influence affects the amount of flux striking the receptor head during the recording session.
- D. Document measurements in clearly understandable format for review by the Architect. Include time of measurement, temperature, and relative humidity.
- E. Measure illuminance at least two hours after local sunset with full output of electric lighting. Record integrated illuminance and average illuminance for a 2 hour period.
- F. During daylight hours, measure illuminance with electric lighting off, including emergency and nightlight circuits. Record integrated illuminance and average illuminance for a two hour period. Document in clearly understandable format for review by the Architect.

- G. Set each photocell to 150 percent of electric-only lighting contribution.
- H. After initial setpoint has been set, measure illuminance in 10 minute increments from 1 hour before to 1 hour after local sunset.
- I. Submit recorded data to Architect for review.

3.04 TESTING FOR SEASONAL VARIATIONS

- A. Timing of Commissioning:
 - 1. Initial Commissioning:
 - a. Perform to best suit the current time-of-year and cloud cover conditions.
 - b. Conduct as done as soon as contract work is completed regardless of season.
 - 2. Seasonal Commissioning: Test under full sunlight and full overcast conditions during summer and winter solstice, as well as similar conditions at the spring or fall equinox.
 - 3. Subsequent Commissioning: Ascertain adequate performance during the four seasons.

3.05 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start up systems within Division 26, Electrical. The same technicians made available to assist the Test Engineer and Commissioning Agent in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested, and coordinated by the Test Engineer. Under Division 26, Electrical, ensure that the qualified technician(s) are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments, and problem resolutions at no additional cost to the Owner.
- B. System problems and discrepancies may require additional technician time, Test Engineer time, Commissioning Agent time, redesign, and reconstruction of systems and system components. The additional technician time made available for the subsequent commissioning periods until the required system performance is obtained at no additional cost to the Owner.
- C. Commissioning Agent reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service the commission the equipment, and a willingness to work with the Test Engineer and Commissioning Agent to get the job done. Remove technicians from the project at the request of either the Test Engineer or Commissioning Agent.

3.06 RESOLUTION OF DEFICIENCIES

- A. In some systems, misadjustments, misapplied equipment, and deficient performance will result in additional work required to commission the systems.
- B. Complete work under the direction of the Architect, with input from the Contractor, equipment supplier, Test Engineer, and Commissioning Agent.
- C. Whereas members will have input and the opportunity to discuss the work and resolve problems, the Architect will have final jurisdiction on the necessary work to be done to achieve performance.
- D. Complete corrective work in a timely fashion to permit timely completion of the commissioning process.
- E. Experimentation to render system performance is permitted. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Agent will notify the Owner, indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities.

- F. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services, equipment, or both, to resolve the problem.
- G. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.07 TRAINING

- A. Participate in the training of Owner's engineering and maintenance staff, as required in Divisions 01 through 28, on each system and related components.
- B. Conduct training in a classroom setting, with system and component documentation, and suitable classroom training aids.
- C. Training classroom sessions and file demonstrations will be videotaped and copies of this material will be provided as part of closeout requirements.
- D. Training will be conducted jointly by the test engineer, commissioning agent, the Contractor, and the equipment suppliers.
- E. Test engineer responsible for highlighting system peculiarities specific to this project.

3.08 SYSTEMS DOCUMENTATION

- A. In addition to the requirements of Division 01, General Requirements, update contract documents to incorporate field changes and revisions to system designs to account for actual constructed configurations.
- B. Division 26, Electrical, record drawings include architectural floor plans and the individual daylight control systems in relation to actual building layout.
- C. Provide in AutoCAD .dwg format for transmittal to the test engineer.

END OF SECTION

SECTION 26 09 43
NETWORK LIGHTING CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Lighting Control Equipment

1.02 RELATED SECTIONS

- A. Division 01, General Requirements
- B. Division 26, Electrical
- C. Division 23, Heating, Ventilation, and Air Conditioning
- D. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables
- E. Section 26 09 23 - Lighting Control Devices
- F. Section 26 27 26 - Wiring Devices
- G. Section 26 50 00 - Lighting

1.03 QUALITY CONTROL

- A. Install by an experienced contractor in the installation of lighting control systems. Provide a factory technician to supervise the installation and installation and make final adjustment and tests of the system.
- B. Furnish evidence of an experienced service organization which stocks system parts and is capable of providing repair service within 24 hours.

1.04 SUBMITTALS

- A. Shop Drawings
- B. Product Data with Wiring Schematics
- C. Installation and Record Drawings
- D. Operation and Maintenance Manuals

1.05 SYSTEM OPERATION

- A. Use a modular component approach, utilizing a central processor, transceivers which activate relays and relay cabinets.
- B. Incorporate the following criteria:
 - 1. Control information from the controller to the transceiver multiplexed over a single pair of wires.
 - 2. Conform control wiring to NEC Article 725, Class 2.
 - 3. Components: Standard catalog items available through electrical distributors.
 - 4. Expandable to control up to 4,000 relays. Relays operable from 2 or 3-wire control systems.
 - 5. Programmable on site to achieve control functions and be readily updatable to reflect changes without requiring rewiring.
- C. Installed system capable of the following control functions:

1. Automatic Control: Areas to be activated in user dictated patterns (ON-OFF array of relays) according to either a weekly schedule broken into one-minute increments or alternate daily schedules pre-programmed for holidays.
 2. Manual Controls: Control relay or group of relays with either a maintained or momentary switch; activate group of relays to one of ten user determined patterns via a touchtone or pushbutton phone or the controller keyboard.
- D. Select, activate, and lock-in lighting pattern from the central controller with provisions to lock out manual and automatic commands.
- E. A CRT display capable of displaying:
1. Pattern schedules and overrides.
 2. Priority manual overrides.
 3. Current state of each relay in system.
 4. Time, day, and date.
- F. Indicate to the operator transceiver failure.
- G. Internal battery backup of ten hours for memory protection. Store program information on a disc and automatically reload the controller after a power outage longer than the battery backup.
- H. Capable of turning on circuits for continued operation should control component fail.
- I. A self-diagnostic routine to indicate a malfunction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Controls: Wavelinx Wireless Control Cabling
- B. G.E.
- C. LC&D
- D. Power Line Communications
- E. Or approved equivalent.

2.02 LIGHTING CONTROL EQUIPMENT

- A. Main Controller:
1. Microcomputer pre-programmed for lighting control. Incorporate a 365-day clock and provide minute-by-minute control of the entire lighting system of up to 4,000 separate relays according to a pre-determined schedule.
 2. Accepts the lighting control schedule through a simple keyboard. In addition to the automatic schedule, control lighting circuit manually from the controller keyboard.
 3. Provide monitoring of the system and display the ON/OFF state of each relay.
 4. Capable of driving a standard printer.
 - a. CPU: PC class personal computer with memory, cables, and software, factory tested prior to shipment.
 - b. Include lighting control system operating software and current version of Windows operating system.
 - c. Include Trends and Relay Runtime Analysis software to allow the owner to analyze the operation of specific areas and identify those exceeding normal runtimes. Individual relays may be assigned a kWh weighted value or simply analyzed on a runtime basis. In both cases, the relays may be assigned to logical groups and plotted for the last 30 days or 12 months.

- B. Telephone Interface Unit:
 - 1. Built into the controller and allow the controller to connect to standard telephone system which has pushbutton (Touchtone) capability using a standard modular telephone jack.
 - 2. Each interface provides a telephone extension number for the controller. To increase accessibility to the controller, three of these interfaces built into the central controller.
 - 3. Capable of handling calls on three units simultaneously.
- C. Relay/Transceiver Cabinets:
 - 1. Code gauge steel cabinets, surface, with cover and following interior devices.
 - a. 20A, 277V relays with 24V, 2 or 3 wire control, quantities as scheduled with space for 32 minimum.
 - b. 277V primary, 24V secondary control transformer.
 - c. Plug-in modular electronics to operate multiple relays as schedules, individually or in groups as directed by the controller.
 - d. Plug-in modular electronics for inputs which will notify the controller of change in input.
 - e. Terminals for system wiring.
 - f. Transceivers for input output control.
- D. Wire:
 - 1. Data line, 18 AWG minimum size, shielded twisted pair, stranded copper, color coded, 300V minimum insulation. Twist wires every 3-inches or less.
 - 2. Wiring from low voltage switches or other controlling devices to the transceivers inputs and wiring from transceivers to remote mounted relays 18 AWG minimum, stranded copper, color coded, 300V minimum insulation. Multiconductor cable assembly may be used at contractor's option.
- E. Low Voltage Switch Modules:
 - 1. Master:
 - a. G.E.
 - b. RMP2-35-RK1 with RS2-37P switches
 - c. Or approved equivalent.
 - 2. Single:
 - a. G.E. RP2-117 with RS2-37P switches
 - b. Or approved equivalent.
- F. Photocells:
 - 1. Accept indoor, skylight, and outdoor photosensing heads.
 - 2. Photosensing control permits the user to specify the actual footcandle level where desired switching occurs.
 - 3. An internal deadband timer exist to prevent the lights under photosensor control to toggle inadvertently as the sensor passes through the control threshold.
 - 4. Provide one analog system photocell.

PART 3 EXECUTION

3.01 DRAWINGS

- A. Installation and record drawings called for under submittals consists of reproducible drawings with outlets, devices, terminal cabinets, conduits and wiring shown. Prints of these drawings submitted for approval prior to starting installation. Upon request, the Architect will furnish reproducible floor plans as required for the contractor's use in developing the Installation and Record Drawings.
- B. Submit drawings when approved and form the basis for installation.

- C. Incorporate at the completion of the work deviations from the installation drawings on the reproducibles to indicate as built conditions. Submit drawings as Record Drawings for the system.

3.02 INSTALLATION

- A. Install systems for each section of each floor and connect lighting circuits per relay schedule on drawings.
- B. Area control switches able to manually provide 2-level control of lights by area.
- C. Provide conduit for wiring, 1/2 inch minimum size.
- D. Components for cabinets factory installed.
- E. Install cabinets plumb, adjacent to serving lighting panel in electrical rooms as shown on the Drawings.

3.03 INSTRUCTION

- A. Without additional expense to the Owner, competent authorized representative personnel gives instruction for the care, adjustment, and operation of all parts of the system to the Owner's representative who is to have charge of the equipment.
- B. Each instructor thoroughly familiar with parts of the installation and trained in operating theory as well as in practical operation and system maintenance.
- C. Furnish 16 hours of instruction after final acceptance of the system at the dates and times selected by the Owner.
- D. Installation, start-up, and maintenance assistance available from the manufacturer on an as-needed basis.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- F. Section 26 27 13 - Electricity Metering.
- G. Section 26 43 00 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- D. NECA 400 - Standard for Installing and Maintaining Switchboards.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
- G. NEMA PB 2 - Deadfront Distribution Switchboards.
- H. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.
- I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.
- J. NFPA 70 - National Electrical Code.
- K. UL 98 - Enclosed and Dead-Front Switches.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
- M. UL 869A - Reference Standard for Service Equipment.
- N. UL 891 - Switchboards.
- O. UL 977 - Fused Power-Circuit Devices.

- P. UL 1053 - Ground-Fault Sensing and Relaying Equipment.

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 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. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
 3. See Section 26 21 00 for Utility Company contact information and additional requirements.
 4. Obtain Utility Company approval of switchboard prior to fabrication.
 5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
 6. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 4. Include documentation of listed series ratings upon request.
 5. Include documentation demonstrating selective coordination upon request.
- D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.
- 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. Field Quality Control Test Reports.
- H. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Enclosure Keys: Two of each different key.
 - 3. Electronic Trip Circuit Breakers: Provide one portable test set.
 - 4. Drawout Devices:
 - a. Handles Necessary for Racking of Devices: One for each electrical room containing switchgear with drawout devices.
 - b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout devices.
 - c. Portable Lifting Devices: One for each electrical room containing switchboards with drawout devices and no integral top rail-mounted lifting device.
 - d. Removable Covers: One for blocking each different opening size when device is temporarily removed from its compartment.
 - 5. See Section 26 28 13 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. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. 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 switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Switchboards:

1. Eaton Corporation.
 2. General Electric Company.
 3. Schneider Electric; Square D Products.
 4. Siemens Industry, Inc.
- B. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Furnish switchboards 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 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
1. Main Device(s): Individually-mounted.
 2. Feeder Devices: Panel/group-mounted.
 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
 4. Gutter Access: Bolted covers.
- E. Service Entrance Switchboards:
1. Listed and labeled as suitable for use as service equipment according to UL 869A.
 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 3. Comply with Utility Company requirements for electrical service.
 4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
 5. See Section 26 21 00 for additional requirements.
- F. Switchboards With Busway Transitions: Configured for bussed connection to busway provided in accordance with Section 26 25 13.
- G. Switchboards With Fire Pump Taps: Provide separate bussed vertical section with suitable lugs for fire pump connection to line side of main service disconnect device(s).
- H. Switchboards With Drawout Devices: Provide integral top rail-mounted lifting device where indicated.
- I. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude: Less than 6,600 feet.
 - b. Ambient Temperature:

- 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
 - 2) Switchboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
- J. Short Circuit Current Rating:
1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
 2. Minimum Rating: 65,000 rms symmetrical amperes.
 3. Listed series ratings are acceptable only where specifically indicated.
 4. Label equipment utilizing series ratings as required by NFPA 70.
- K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- L. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- M. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 4. Phase and Neutral Bus Material: Aluminum.
 5. Ground Bus Material: Aluminum.
- N. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 2. Load Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Lug Type:
 - 1) Provide mechanical lugs unless otherwise indicated.
 - 2) Provide compression lugs where indicated.
- O. Enclosures:
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - b. Outdoor Locations: Type 3R.
 2. Finish: Manufacturer's standard unless otherwise indicated.
 3. Enclosure Space Heaters:
 - a. Provide in each switchboard section installed outdoors and in unconditioned indoor spaces.
 - b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
 - c. Heater Control: Thermostat.

- d. Heater Power Source: Provide connection to transformer factory-installed in switchboard or suitable external branch circuit as indicated or as required.
- 4. Outdoor Enclosures:
 - a. Enclosure Type: Non-walk-in type unless otherwise indicated.
 - b. Color: Manufacturer's standard.
 - c. Access Doors: Lockable, with all locks keyed alike.
 - d. Walk-in Enclosure Features:
 - 1) Personnel Doors: Open to exterior; equipped with panic hardware.
 - 2) Aisle lighting, with switch at each access door.
 - 3) GFCI duplex convenience receptacle.
- P. Future Provisions:
 - 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
 - 2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
 - 3. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.
- Q. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list switchboards as a complete assembly including surge protective device.
- R. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where overcurrent protective devices 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 or residual ground fault detection method unless otherwise indicated.
 - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
 - c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
- S. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- T. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Devices:
 - 1. Fusible Switches:
 - a. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - b. Fuse Clips: As required to accept indicated fuses.

- 1) Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- c. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
2. Fused Power-Circuit Devices:
 - a. Description: Quick-make, quick-break, dead-front bolted-pressure contact switches and high-pressure butt contact switches listed and labeled as complying with UL 977; ratings, configurations, and features as indicated on the drawings.
 - b. Bolted-Pressure Contact Switches: Devices with additional pressure or clamping action provided at both ends of switch blades when blades are in the fully closed position.
 - c. High-Pressure Butt Contact Switches: Devices with butt-type contacts and spring-charged mechanism.
 - d. Minimum Short Circuit Current Rating: 200,000 rms symmetrical amperes when protected by Class L fuses.
 - e. Fuse Clips: As required to accept Class L fuses.
 - f. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
 - g. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating switch position.
 - 3) Blown fuse protection and indication.
- B. Circuit Breakers:
 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - c. 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.
 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 250 amperes.
 - 2) Provide electronic trip circuit breakers for circuit breaker frame sizes 250 amperes and above.
 - b. Minimum Interrupting Capacity:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.

- 2) 14,000 rms symmetrical amperes at 480 VAC.
- c. 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.
 - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - 2) Provide interchangeable trip units where indicated.
- d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.
 - 2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
 - 3) Provide communication capability where indicated: Compatible with system indicated.
- e. Circuit breakers that are 1200 amp and larger rated, or can be adjusted to be 1200 amp or larger rated: Provide with an energy reducing maintenance switch adjustment to meet the requirements of NEC 240.87.
- f. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.
- g. Circuit-breaker frame sizes 250 A and larger shall be 100% rated to continuously carry their full ampere capacity.
- h. Provide the following circuit breaker types where indicated:
 - 1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
 - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- i. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
 - 3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

- 4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
 - 5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
 - 6) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 7) Communication Capability: Communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
 - 8) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
 - 9) Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - 10) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 11) Handle Clamp: Loose attachment, for holding circuit-breaker handles in on position.
3. Insulated Case Circuit Breakers:
- a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
 - b. Operation:
 - 1) Provide manually operated circuit breakers unless otherwise indicated.
 - 2) Provide electrically operated circuit breakers where indicated.
 - 3) Pad-Lock Provision: For preventing circuit breaker closing operation.
 - c. Construction:
 - 1) Provide fixed-mount circuit breakers unless otherwise indicated.
 - 2) Provide drawout circuit breakers where indicated.
 - d. Drawout Circuit Breakers:
 - 1) Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
 - 2) Provide safety interlock to prevent racking of circuit breaker while in the ON position.
 - 3) Pad-Lock Provision: For preventing circuit breaker drawout operation.
 - e. Minimum Interrupting Capacity:
 - 1) 42,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2)
 - f. Trip Units: Solid state, microprocessor-based, true rms sensing.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.

- 2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
- 3) Provide communication capability where indicated: Compatible with system indicated.
- g. Circuit breakers that are 1200 amp and larger rated, or can be adjusted to be 1200 amp or larger rated: Provide with an energy reducing maintenance switch adjustment to meet the requirements of NEC 240.87.
- h. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.
- i. Circuit-breaker frame sizes 250 A and larger shall be 100% rated to continuously carry their full ampere capacity.
- j. Provide the following circuit breaker types where indicated:
 - 1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
 - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- k. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
 - 3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
 - 4) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
 - 5) Truck-Operated Cell Switch: For indicating circuit breaker racking position.
 - 6) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 7) Communication Capability: Communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
 - 8) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
 - 9) Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.

- 10) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- 11) Handle Clamp: Loose attachment, for holding circuit-breaker handles in on position.

2.04 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
 1. Dielectric tests.
 2. Mechanical operation tests.
 3. Grounding of instrument transformer cases test.
 4. Electrical operation and control wiring tests, including polarity and sequence tests.
 5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. 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 switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 3.5 inch high concrete pad constructed in accordance with Section 03 30 00. Pad should extend nominally 2-inches beyond edges of the equipment.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed devices, components, and accessories.
- J. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.
- M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

- N. Provide filler plates to cover unused spaces in switchboards.
- O. Identify switchboards in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.
- C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- E. Inspect and test in accordance with NETA ATS, except Section 4.
- F. Perform inspections and tests listed in NETA ATS, Section 7.1.
- G. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- H. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.
- I. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- J. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- K. Test shunt trips to verify proper operation.
- L. Correct deficiencies and replace damaged or defective switchboards or associated components.
- M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- C. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated 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: Manufacturer's authorized representative.
 - 4. Location: At project site.

3.07 PROTECTION

- A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

**SECTION 26 24 13
SWITCHBOARDS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Switchboards.
- B. Metering transformer cabinets.
- C. Meter bases.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for supporting foundations and pads.
- B. Section 26 28 13 - Fuses and Circuit Breakers.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- D. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.
- E. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.
- F. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 891 - Standard for Safety Switchboards; Underwriters Laboratories, Inc.; 2005.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.
- 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. Project Record Documents: Record actual locations of switchboards.
- F. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 63 00 - Product Substitution Procedures Requirements, for additional provisions.
 - 2. Enclosure Keys: Two of each different key.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section.
- C. Perform work in accordance with utility company written requirements and NFPA 70.
 - 1. Maintain one copy of each document on site.

- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- 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 in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Electrical: www.eatonelectrical.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens: www.sea.siemens.com.

2.02 SWITCHBOARDS

- A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
- B. Ratings:
 - 1. Voltage and bus ampacity rating: As indicated on drawings.
 - 2. Integrated Equipment Rating: Rating shall exceed available utility fault current.
 - 3. Main service board shall be service entrance rated.
- C. Bus Material: Copper or aluminum with tin plating, standard size.
- D. Bus Connections: Bolted, accessible from front for maintenance.
- E. Ground Bus: Extend length of switchboard.
- F. Insulated Ground Bus: Extend length of switchboard.
- G. Fusible Switch Assemblies: NEMA KS 1, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lock in OFF position. Fuse clips: Designed to accommodate Class R or Class J fuses, type as specified.
- H. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse clips: Designed to accommodate Class L fuses.
- I. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.
 - 1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 - 2. Include shunt trip where needed.
 - 3. Provide Arc Flash reduction switch with maintenance mode for breakers as required by Code.
- J. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- K. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with utility company's requirements.

- L. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- M. Pull Box: Removable top and sides, same construction as switchboard.
 - 1. Size as shown on Drawings.
 - 2. Set front back sufficient distance to accommodate circuit breaker lifting devices.
 - 3. Provide insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.
- N. Enclosure: Type 1 - General Purpose.
 - 1. Align sections at rear only.
 - 2. Switchboard Height: 90 inches, excluding floor sills, lifting members and pull boxes.
 - 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.03 COMPONENTS

- A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
 - 1. Size: As required by utility.
- B. Meter Base: As required by utility company.
- C. Other Components: As required by utility company.

2.04 SOURCE QUALITY CONTROL

- A. Shop inspect and test switchboard according to NEMA PB 2.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Provide concrete housekeeping pad under the provisions of Section 03 30 00.
- B. Arrange with utility company to obtain permanent electric service to the Project.
- C. Verify that field measurements are as instructed by manufacturer and as indicated on utility company drawings.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment components in accordance with Section 26 05 29.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Provide filler plates to cover unused spaces in switchboards.
- L. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.

- M. Install transformer pad and/or vault, metering transformer cabinets, and meter base as required by utility company.
- N. Install in a neat and workmanlike manner, as specified in NECA 400.
- O. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- P. Install fuses in each switch.

3.03 FIELD QUALITY CONTROL

- A. Perform field testing in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

3.04 ADJUSTING

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.
- C. For systems with adjustable trip circuit breakers, provide coordination study for review. Adjust circuit breaker trip and time delay settings to values indicated on coordination study. Submit to Architect for review.

3.05 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 27 13 - Electricity Metering: For interface with equipment specified in this section.
- F. Section 26 43 00 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
- G. NEMA PB 1 - Panelboards.
- H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.
- J. NFPA 70 - National Electrical Code.
- K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.
- L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.
- M. UL 67 - Panelboards.
- N. UL 98 - Enclosed and Dead-Front Switches.
- O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

- P. UL 869A - Reference Standard for Service Equipment.
- Q. UL 943 - Ground-Fault Circuit-Interruptioners.
- R. UL 1053 - Ground-Fault Sensing and Relaying Equipment.
- S. UL 1699 - Arc-Fault Circuit-Interruptioners.

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 26 05 00 - Common Work Results for Electrical, 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.
 - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- 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 dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.
 - 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 - 4. Include documentation of listed series ratings upon request.
- 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 60 00 - Product Requirements, for additional provisions.
 - 2. Panelboard Keys: Two of each different key.

3. See Section 26 28 13 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. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. 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.
 2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation
- B. General Electric Company
- C. Schneider Electric; Square D Products
- D. Siemens Industry, Inc
- E. Substitutions: See Section 01 60 00 - Product Requirements.
- 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.

- b. Panelboards Containing Fusible Switches: Between -22 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 indicated on the drawings.
 - 2. Listed series ratings are acceptable only where specifically indicated.
 - 3. Label equipment utilizing series ratings as required by NFPA 70.
- 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 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
 - 3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- 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 removable end walls for NEMA Type 1 enclosures.
 - d. 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 43 00, list and label panelboards as a complete assembly including surge protective device.

- L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
 - 1. Ampere Rating: Not less than ampere rating of panelboard bus.
 - 2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
 - 3. Coil Voltage: As required for connection to control system indicated.
- M. 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.
 - c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
- N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- O. 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.
- P. Load centers are not acceptable.
- Q. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Feed-through lugs.
 - 2. Sub-feed lugs.
 - 3. Main circuit breakers.
- R. Metering:
 - 1. Where indicated on Design Drawings, provide microprocessor-based digital electrical metering system including instrument transformers, wiring, and connections necessary for measurements specified.
 - 2. Metering type to be as indicated on Design Drawings
 - a. See Section 26 27 13 for metering equipment requirements.

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. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase and Neutral Bus Material: Aluminum.
 - 2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:
 - 1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
 - 2. Provide thermal magnetic circuit breakers unless otherwise indicated.

3. Provide electronic trip circuit breakers where indicated.
- E. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.
- F. Circuit-breaker frame sizes 250 A and larger shall be 100% rated to continuously carry their full ampere capacity.
- G. Enclosures:
 1. Provide surface-mounted enclosures unless otherwise indicated.
 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.
- H. Metering:
 1. Where indicated on Design Drawings, provide microprocessor-based digital electrical metering system including instrument transformers, wiring, and connections necessary for measurements specified.
 2. Metering type to be as indicated on Design Drawings
 - a. See Section 26 27 13 for metering equipment requirements.

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. Conductor Terminations:
 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Main and Neutral Lug Type: Mechanical.
- C. 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.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.
- G. Metering:
 1. Where indicated on Design Drawings, provide microprocessor-based digital electrical metering system including instrument transformers, wiring, and connections necessary for measurements specified.
 2. Metering type to be as indicated on Design Drawings
 - a. See Section 26 27 13 for metering equipment requirements.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 2. Fuse Clips: As required to accept indicated fuses.
 - a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
 4. 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.
- B. 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.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - c. 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. Acceptable only where specifically indicated.
 3. 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.
 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 225 amperes and larger.
 - b. Provide interchangeable trip units where indicated.
 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.

- b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
- c. Provide communication capability where indicated: Compatible with system indicated.
6. Provide 100 Percent Rated Circuit Breakers for circuit breaker frame sizes 250 amperes and larger.
7. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
8. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
 - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
 - e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
 - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
 - g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
9. Do not use tandem circuit breakers.
10. Do not use handle ties in lieu of multi-pole circuit breakers.
11. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
12. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
 - c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
 - d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
 - e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.06 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 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 05 29.
- 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 30 00.
- J. Provide minimum of six 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 05 26.
 - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
 - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- L. Install all field-installed branch devices, components, and accessories.
- M. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- P. Set field-adjustable circuit breaker tripping function settings as indicated.
- Q. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- R. Provide filler plates to cover unused spaces in panelboards.
- S. 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.

T. Identify panelboards in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.
- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- F. Test GFCI circuit breakers to verify proper operation.
- G. Test AFCI circuit breakers to verify proper operation.
- H. Test shunt trips to verify proper operation.
- I. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- J. 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 24 16
PANELBOARDS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Load centers.

1.02 REFERENCE STANDARDS

- A. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- B. NEMA PB 1 - Panelboards; 2011.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- 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 of panelboards and record actual circuiting arrangements.
- E. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 63 00 - Product Substitution Procedures Requirements, for additional provisions.
 - 2. Panelboard Keys: One of each different key for each panelboard.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens: www.sea.siemens.com.
- E. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.

2.02 POWER DISTRIBUTION PANELBOARDS

- A. Description: NEMA PB 1, circuit breaker type or fusible switch type, as indicated on drawings..

- B. Panelboard Bus: Copper or aluminum, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating shall be larger than the available fault current, but no less than:
 - 1. 240 Volt Panelboards: 10,000 amperes rms symmetrical.
- D. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R or Class J fuses.
- E. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.
- F. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Panelboard Bus: Ratings as indicated. Provide copper or aluminum ground bus in each panelboard.
- B. Minimum Integrated Short Circuit Rating shall be larger than the available fault current, but no less than:
 - 1. 240 Volt Panelboards: 10,000 amperes rms symmetrical.
- C. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
 - 4. Do not use tandem circuit breakers.
- D. Cabinet Box: 6 inches deep, 20 inches wide.
- E. Cabinet Front: Type with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel. Interior trim shall be of dead-front construction to shield user from all energized parts. Surface or flush mounting as indicated on drawings.

2.04 LOAD CENTERS (RESIDENTIAL UNITS ONLY)

- A. Description: Circuit breaker load center, with bus ratings as indicated.
- B. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical.
- C. Molded Case Circuit Breakers: Plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles; UL listed.
 - 1. Type SWD for lighting circuits.
 - 2. Class A ground fault interrupter circuit breakers where indicated.
 - 3. Do not use tandem circuit breakers.
 - 4. Provide handle ties to connect single pole circuit breakers in multiwire branch circuits.
 - 5. Provide AFCI circuit breakers as required by code.
- D. Enclosure: General Purpose.
- E. Box: Type with door, and pull ring and latch on door. Finish in manufacturer's standard White enamel. Interior trim shall be of dead-front construction to shield user from all energized parts.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mounting Height:

1. General: 6 feet 6 inches to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
2. Dwelling Units: Mount load center to meet ADA accessible side reach location and height per OSSEC 1110.3.4.
 - B. Provide filler plates for unused spaces in panelboards.
 - C. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
 - D. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

3.02 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS, except Section 4.

END OF SECTION

**SECTION 26 27 01
WALL-MOUNTED GROUP METERING EQUIPMENT**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Meter stacks.
- B. Meter centers.
- C. Meter bases.

1.02 RELATED REQUIREMENTS

- A. Section 26 28 13 - Fuses and Circuit Breakers.

1.03 REFERENCE STANDARDS

- A. ANSI C12.1 - American National Standard Code for Electricity Metering; 2001.
- B. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- E. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 486B - Wire Connectors for Use with Aluminum Conductors; Underwriters Laboratories, Inc.; 1997
- H. UL 869A - UL Standard for Safety Reference Standard for Service Equipment; Underwriters Laboratories, Inc.; 2006

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, and fault current withstand ratings of all equipment and components.
- C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground.
- 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. Project Record Documents: Record actual locations of equipment.
- F. Maintenance Data: Include spare parts listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 63 00 - Product Substitution Procedures Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section.
- C. Perform work in accordance with utility company written requirements and NFPA 70.
- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
 - 1. UL 486B.
 - 2. UL 869A.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- 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.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Electrical: www.eatonelectrical.com.
- B. GE Industrial: www.geindustrial.com.
- C. Square D: www.squared.com.
- D. Siemens: www.sea.siemens.com.

2.02 METERING EQUIPMENT

- A. Description: Wall-mounted metering equipment with electrical ratings and configurations as indicated and specified.
- B. Ratings:
 - 1. Voltage and bus ampacity rating: As specified herein.
 - 2. Integrated Equipment Rating: Greater than available fault current.
 - 3. Main service board shall be service entrance rated.
- C. Bus Material:
 - 1. All bus bars shall be tin-plated aluminum or copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on UL standard temperature rise criteria for multi-metering equipment.
 - 2. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.
 - 3. All hardware used for aluminum bus bar connections shall be high-tensile strength, zinc-plated. Provide Belleville-type spring washers for all bus joints.
- D. Bus Connections:
 - 1. Crimp-type termination provisions shall be provided for all line terminations suitable for copper or aluminum cable and rated at 75 degrees C.
 - 2. Lugs shall be provided in the incoming line section for connection of the main grounding conductor.
- E. Tenant Utility Metering
 - 1. For EUSERC serviced areas, meter centers shall incorporate metering sections with tenant feeder circuits using ring-type meter sockets rated 125 or 200 amperes to meet local utility and/or customer requirements.
 - 2. The self-contained meter sockets shall include a test bypass/disconnect block per EUSERC requirements.
- F. Tenant disconnects shall be wired for hot sequence and shall be molded case circuit breakers.

- G. Line and Load Terminations: Accessible from the front only of the assembly, suitable for the conductor materials and sizes indicated.
- H. Enclosure: Type 1.
 - 1. Align sections at rear only.
 - 2. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.03 COMPONENTS

- A. Meter Base: As required by utility company.
- B. Other Components: As required by utility company.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Arrange with utility company to obtain permanent electric service to the Project.
- B. Verify that field measurements are as instructed by manufacturer and as indicated on utility company drawings.

3.02 INSTALLATION

- A. Install assemblies in locations shown on drawings.
- B. Install transformer pad and/or vault, metering transformer cabinets, and meter base as required by utility company.
- C. Install in a neat and workmanlike manner, as specified in NECA 1.
- D. Tighten accessible bus connections and mechanical fasteners after placing equipment.

3.03 FIELD QUALITY CONTROL

- A. Perform field testing in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

3.04 ADJUSTING

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.

3.05 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 27 13
ELECTRICITY METERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Equipment for Owner Electricity Metering
- B. Basic Electricity Metering:
 - 1. Single circuit electricity meters.
 - 2. Multi-circuit electricity meters.
 - 3. Branch circuit electricity meter (BCEM).
- C. Ethernet Gateway for Electricity Meters
- D. Data Acquisition Servers

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems: Cabinets and enclosures for metering system components.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 24 13 - Switchboards: For interface with meters specified in this section.
- F. Section 26 24 16 - Panelboards: For interface with meters specified in this section.
- G. Section 26 28 13 - Fuses.
 - 1. Includes requirements for spare fuses and spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.
- E. NFPA 70 - National Electrical Code.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
 - 2. Coordinate the work with other installers to provide communication lines required for electricity metering system interface.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Conduct meeting with facility representative and other related equipment manufacturers to discuss electricity metering system interface requirements.

1.05 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittal procedures.
- B. Product Data:
 - 1. Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories.
 - 2. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.
 - 3. Include manufacturer's published data tables with complete listing of metering device Modbus registers and/or BacNet Object IDs with associated data descriptions, formats, units, scale factors.
- C. Shop Drawings:
 - 1. Include system interconnection schematic diagrams showing all factory and field connections. Diagrams to include potential transformer (PT) and current transformer (CT) connections that clearly indicate the point(s) of metering device sensing within the electrical distribution system to be metered and indicate the CT orientation (polarity) with respect to the metered circuit.
 - 2. Include requirements for interface with other systems.
- 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. Field Quality Control Test Reports.
- F. Project Record Documents:
 - 1. Final as built system interconnection schematic diagrams.
 - 2. Final equipment settings:
 - a. Device usernames and passwords updated from factory defaults.
 - b. TCP/IPv4 network settings for all Ethernet enabled meters configured for Modbus/TCP or BacNet/TCP
 - c. TCP/IPv4 network settings for all Ethernet enabled electrical metering equipment gateways and/or protocol converters.
 - d. Modbus slave IDs for all RS485 enabled meters.
 - e. Meter device configuration reports.
 - f. Meter device setting file exports.
- 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 60 00 - Product Requirements, for additional provisions.
 - 2. Enclosure Keys: Two of each different key.
 - 3. See Section 26 28 13 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. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- D. 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.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Electricity Meters - Basis of Design: Electro Industries.
- B. Other Acceptable Manufacturers:
 - 1. Leviton
 - 2. Veris Industries
 - 3. Same as manufacturer of electrical distribution equipment used for this project.
 - a. Eaton Corporation.
 - b. Schneider Electric.
 - c. Siemens Industry, Inc.
 - d. Atom Power, Inc.
- C. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- E. Source Limitations: Furnish electricity meters produced by a single manufacturer and obtained from a single supplier.

2.02 EQUIPMENT FOR OWNER ELECTRICITY METERING

- A. Provide microprocessor-based digital electricity metering systems including instrument transformers, wiring, and connections necessary for measurements specified.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.
- D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.
- E. Meters
 - 1. Designed for multifunction electrical measurement on 3 phase power systems. Meter to perform to spec in harsh electrical applications in high and low voltage power systems.
 - 2. Support 3 element Wye, 2.5 element Wye, 2 element Delta, 4 wire Delta systems.
 - 3. Surge Withstand: conform to IEEE C37.90.1
 - 4. Fault Current Withstand: 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second.
 - 5. Inputs and outputs: galvanically isolated to 2500 VAC.

- F. Enclosures:
1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 26 05 33.16 - Boxes for Electrical Systems.
 2. 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 or Type 4.
 3. Provide lockable door(s) for outdoor locations.
 4. Finish: Manufacturer's standard unless otherwise indicated.
- G. Instrument Transformers:
1. Comply with IEEE C57.13, where applicable.
 2. Select suitable ratio, burden, and accuracy as required for connected devices, including protective relay equipment that may be present in the design.
 3. Select suitable insulation/voltage class for the circuit to be metered.
 4. Current Transformers:
 - a. Solid Core CTs for less than or equal to 400A primary metering applications unless otherwise noted in Design.
 - b. Split Core CTs for 600A and greater primary metering applications unless otherwise noted in Design.
 - c. Rogowski CTs permitted only with pre-bid approval or as indicated in the Design.
 - d. Compatible with connected meters; replace meters damaged by connection of incompatible current transformers.
 - e. Provide shorting terminal blocks for connection of secondaries where applicable.
 - f. CT line voltage terminals to be finger safe.
 5. Potential Transformers:
 - a. Include primary and secondary fuses with disconnecting means.
 - b. CT line voltage terminals to be finger safe.
- H. Interface with Other Work:

2.03 BASIC ELECTRICITY METERS

- A. Electricity meters with "M|B" annotations as indicated on Design Documents are subject to the requirements of this Part. Basic electricity meters can be Single Circuit, Multi-Circuit or Branch Circuit type electricity meters as indicated on Design Documents.
- B. Basic Electricity Meter equipment to be connected to Facility Building Management System (BMS)
1. Basic meters to communicate with Facility BMS via BACnet-IP communication protocol.
 2. See Design Documentation for additional requirements.
- C. Basic Electricity Meter equipment to be provided with Data Acquisition Servers (DAS)
1. Basic meters to communicate with DAS via BACnet-IP communication protocol.
 2. DAS equipment, if provided, to be dedicated to Division 26 electricity meter data acquisition, storage, display and retrieval.
 3. DAS to be capable of logging hourly interval data from meters and retaining logged data in non-volatile memory for a minimum of 36 months.
 4. See Design Documentation for additional requirements
- D. Single Circuit Electricity Meter
1. Basis of Design:
 - a. Electro Industries Shark 50B
 2. Display:
 - a. Integral LED to present user scrollable display of measured readings.
 3. Enclosure:

- a. Integrated into switchgear or switchboard assembly or into dedicated cabinet. If switchgear/switchboard integrated, the metering section or cubicle will include dielectric barriers to separate the meter equipment space from live electrical components, shock hazards and Arc Flash hazards.
 - b. Include terminal blocks, fuses, power supplies and other accessories as required to satisfy the Design.
- E. Multi-Circuit Electricity Meter
1. Basis of Design:
 - a. Electro Industries Shark MP200
 2. Number of metering points:
 - a. Capable of metering 8 or more three phase circuits via a single multi-point meter assembly and associated enclosure.
 - b. Capable of metering 24 or more single phase circuits via a single multi-point meter assembly and associated enclosure.
 3. Display:
 - a. Optional integral or remote color LED touch screen display to display real time data for each metered point.
 - b. See Design Documents for inclusion and desired location.
 4. Enclosure:
 - a. Integrate into switchgear or switchboard assembly or into dedicated cabinet. If switchgear/switchboard integrated, the metering section or cubicle will include dielectric barriers to separate the meter equipment space from live electrical components, shock hazards and Arc Flash hazards.
 - b. Include terminal blocks, fuses, power supplies and other accessories as required to satisfy the Design.
- F. Branch Circuit Electricity Meter (BCEM)
1. Basis of Design:
 - a. Schneider Electric PowerLogic Branch Circuit Power Meter (BCPM)
 - b. Eaton Power Xpert Branch Circuit Monitor (PXBCM)
 2. As indicated in Design Documents or as required for panelboard branch circuits to be monitored. Product to have configurations available for monitoring up to 84 branch circuits, two 3-phase main devices, and two neutrals with a single meter.
 3. Each branch circuit and main device metering point to be subject to the product and functional requirements of this Part (Basic Electricity Meters).
 4. Display:
 - a. Optional integral or remote color LED touch screen display to display real time data for each metered point.
 - b. See Design Documents for inclusion and desired location.
- G. Basic Electricity Metering Product Requirements:
1. Accuracy:
 - a. Real Power/Energy: Plus/minus 0.5 percent, complying with ANSI C12.20 accuracy and IEC 62053-21, Class 0.5, or IEC 60253-22, Class 0.5S.
 - b. Reactive Power/Energy: Plus/minus 1.0 percent, complying with IEC 62053-24, Class 1, or better.
 - c. Line to Neutral Voltage: Plus/minus 0.2 percent.
 - d. Line to Line Voltage: Plus/minus 0.4 percent.
 - e. Current: Plus/minus 0.2 percent.
 - f. Power Factor: Plus/minus 1.0 percent.
 - g. Frequency: Plus/minus 0.01 Hz.

2. Sampling Frequency, Update Rate and Harmonics:
 - a. Sampling frequency: 400 per cycle (24,000Hz)
 - b. Update rate: 2 seconds (maximum)
 - c. Harmonics Resolution: N/A.
3. Measured Parameters:
 - a. Real energy (kWh); per phase and total of phases.
 - b. Reactive energy (kVARh); per phase and total of phases.
 - c. Apparent energy (kVAh); per phase and total of phases.
 - d. Real power (kW); Average and maximum over a user-specified interval of one hour or less
 - e. Reactive power (kVAR); Average and maximum over a user-specified interval of one hour or less
 - f. Apparent power (kVA); Average and maximum over a user-specified interval of one hour or less
 - g. Bi-directional Energy Measurements:
 - 1) Real/active energy (kWh) and apparent energy (kVAh); imported (from the grid), exported (to the grid), and signed net total.
 - 2) Reactive energy (kVARh); imported (from the grid) and exported (to the grid), per quadrant as defined by IEEE 1459.
 - 3) Maximum demand; real/active power (kW), reactive power (kVAR), and apparent power (kVA); imported (from the grid) and exported (to the grid).
 - h. Current; per phase and average of phases.
 - i. Voltage; line-to-line and line-to-neutral; per phase and average of phases.
 - j. Power factor; per phase and average of phases.
 - k. Frequency.
4. Non-Volatile Memory:
 - a. N/A
5. Data Logging
 - a. N/A
6. Waveform Recording
 - a. N/A
7. Alarm
 - a. N/A
8. Meter Inputs/Outputs (I/O):
 - a. NA
9. Communications:
 - a. Compatible with connected systems. Provide accessories necessary for proper interface.
 - b. Protocol converters not permitted unless otherwise noted in Design Documentation or this Section.
 - c. Serial Communications (at least one of the following):
 - 1) RS-485, 2-wire: support for Modbus RTU
 - 2) RS-485, 2-wire; support for BACnet MS/TP
 - d. Ethernet Communications (at least one of the following):
 - 1) Modbus TCP/IP
 - 2) BacNet IP

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.

- B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive meters.
- D. 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. Provide required support and attachment components in accordance with Section 26 05 29.
- D. Provide grounding and bonding in accordance with Section 26 05 26.
- E. Provide fuses complying with Section 26 28 13 as required.
- F. Identify meters and associated wiring in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
- D. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- E. Correct deficiencies and replace damaged or defective metering system components.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.
 - 1. Testing results report to include meter CT polarity and CT/PT phase relationship verification with respect to the metered circuit and associated directionality of current and power flows.

3.04 ADJUSTING

- A. Program system parameters according to requirements of Owner.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 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: Manufacturer's authorized representative.
 - 4. Location: At project site.

3.07 PROTECTION

- A. Protect installed system components from subsequent construction operations.

END OF SECTION

SECTION 26 27 26

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 26 05 33.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NECA 130 - Standard for Installing and Maintaining Wiring Devices.
- D. NEMA WD 1 - General Color Requirements for Wiring Devices.
- E. NEMA WD 6 - Wiring Devices - Dimensional Specifications.
- F. NFPA 70 - National Electrical Code.
- G. UL 20 - General-Use Snap Switches.
- H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices.
- I. UL 1472 - Solid-State Dimming Controls.

1.04 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Operation and Maintenance Data:

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 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 installed in kitchens.
- F. 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, Unless Otherwise Indicated: Gray with nylon wall plate.
- C. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.

2.03 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated.
 - 2. Leviton Manufacturing Company, Inc.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc.
- B. 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.
- C. 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.
- D. 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.
- E. 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.
- F. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- G. 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.
- H. Locking Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.

2.04 WALL DIMMERS

- A. Manufacturers:

1. Leviton Manufacturing Company, Inc.
 2. Lutron Electronics Company, Inc; Maestro Series.
 3. Pass & Seymour, a brand of Legrand North America, Inc
- B. Wall Dimmers - General Requirements: 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 WALL PLATES

- A. Manufacturers:
1. Hubbell Incorporated.
 2. Leviton Manufacturing Company, Inc.
 3. Lutron Electronics Company, Inc.
 4. Pass & Seymour, a brand of Legrand North America, Inc.
- B. 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.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- E. 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.

2.06 FLOOR BOX SERVICE FITTINGS

- A. Description: Service fittings compatible with floor boxes provided under Section 26 05 33.16 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 05 33.16 as required for installation of wiring devices provided under this section.
 - 1. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Owner to obtain direction prior to proceeding with work.
- 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. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- K. Install wall switches with OFF position down.
- L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- M. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- 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 40 00 - 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. Receptacle testing report form example is as follows:

Receptacle Testing and Acceptance Report Form						Date	
Room/Area	Receptacle Test			Ground System Voltage/Impedance		Grounding	Exceptions/Remarks
	Physical Integrity	Polarity	Tension >4oz	New <20m V	Impedance <0.1 Ohms		

- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CORD CAPS

END OF SECTION

**SECTION 26 27 26
WIRING DEVICES**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Fan speed controllers.
- D. Receptacles.
- E. Wall plates.
- F. Occupancy sensors.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 33.23 - Surface Raceways: Surface raceway systems, including multioutlet assemblies.
- B. Section 26 05 33.16 - Boxes for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 05 83 - Equipment Wiring: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- 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.
- M. UL 1917 - Solid-State Fan Speed 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. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
 6. Notify Architect of any conflicts or deviations from the 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 33 00 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 1. Wall Dimmers: Include derating information for ganged multiple devices.
- C. Samples: One for each type and color of device and wall plate specified, if requested.
- 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, and installation of product.
- F. Operation and Maintenance Data:
 1. Wall Dimmers: Include information on operation and setting of presets.
 2. GFI Receptacles: Include information on status indicators and testing procedures and intervals.
- G. Project Record Documents: Record actual installed locations of wiring devices.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 63 00 - Product Substitution Procedures Requirements, for additional provisions.
 2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
 3. Extra Keys for Locking Switches: Five of each type.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 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 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell-wiring.com. Part numbers indicated are Hubbell; equals by other manufacturers are acceptable, unless otherwise noted.
- B. Leviton Manufacturing Company, Inc.: www.leviton.com.
- C. Lutron Electronics Company, Inc.: www.lutron.com.
- D. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us
- E. Cooper Wiring Devices: www.cooperwiringdevices.com.
- F. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
- G. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 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 GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for all receptacles installed in dwelling units.
- E. Provide GFI protection for all receptacles installed within 6 feet of sinks.
- F. Provide GFI protection for all 15A and 20A, 125V receptacles in non-dwelling type kitchens.
- G. Provide GFI protection for all receptacles serving electric drinking fountains.
- H. Unless noted otherwise, do not use combination switch/receptacle devices.
- I. For flush floor service fittings, use tile rings for installations in tile floors.
- J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.03 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes:
 - 1. All Wiring Devices: Color as selected by Architect with wall plate as specified in wall plates section, unless otherwise indicated.
 - 2. Wiring Devices Installed in Finished Spaces: Color as selected by Architect with wall plate as specified in wall plates section, unless otherwise indicated.
 - 3. Wiring Devices Installed in Unfinished Spaces: Color as selected by Architect with wall plate as specified in wall plates section, unless otherwise indicated.
 - 4. Wiring Devices Installed in Wet or Damp Locations: Color as selected by Architect, with specified weatherproof cover unless otherwise indicated.
- C. All 15 and 20 Amp, 120V wiring devices to be decorra style.

2.04 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com. Part numbers indicated are Hubbell; equals by other manufacturers are acceptable, unless otherwise noted.
 - 2. Leviton Manufacturing Company, Inc.: www.leviton.com.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us
 - 4. Cooper Wiring Devices: www.cooperwiringdevices.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with decorra switch actuator and maintained contacts; switch type as indicated on the drawings.
- C. Residential Wall Switches: Residential specification grade, 15A, 120V with decorra type switch actuator and maintained contacts; switch type as indicated on the drawings.

2.05 WALL DIMMERS

- A. Manufacturers:
 - 1. Leviton Manufacturing Company, Inc.: www.leviton.com.
 - 2. Lutron Electronics Company, Inc.: www.lutron.com. Part numbers indicated are Lutron; equals by other manufacturers are acceptable, unless otherwise noted.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us
 - 4. Hubbell Incorporated: www.hubbell-wiring.com.
 - 5. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.

- B. All Wall Dimmers: 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.
- C. Incandescent Wall Dimmers: 120 V AC, slide control type with separate on/off switch; single pole or three way as indicated on the drawings.
 - 1. Power Rating: Match load indicated on the drawings; 1000 watts minimum.
 - 2. Provide locator light, illuminated with load off.
 - 3. Products:
 - a. Lutron Skylark Series or approved equal.
- D. LED Wall Dimmers: Slide control type with separate on/off switch.
 - 1. Provide locator light, illuminated with load off.
 - 2. Products:
 - a. Lutron Skylark Series or approved equal.
- E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.06 FAN SPEED CONTROLLERS

- A. Manufacturers:
 - 1. Leviton Manufacturing Company, Inc.: www.leviton.com.
 - 2. Lutron Electronics Company, Inc.: www.lutron.com. Part numbers indicated are Lutron; equals by other manufacturers are acceptable, unless otherwise noted.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us
 - 4. Hubbell Incorporated: www.hubbell-wiring.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: 120 V AC, solid-state, three speed, slide control type with slide on/off control, with integral radio frequency interference filtering, fan hum elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.
 - 1. Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the drawings.
 - 2. Products:
 - a. Lutron Skylark Series or approved equal.

2.07 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com.
 - 2. Leviton Manufacturing Company, Inc.: www.leviton.com.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us
 - 4. Cooper Wiring Devices: www.cooperwiringdevices.com.
 - 5. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
- B. All Receptacles: 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 and screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
 - 3. Decorra style.

- C. Convenience Receptacles:
1. Standard Convenience Receptacles in Commercial Areas: Commercial specification grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R; type as indicated on the drawings.
 2. Standard Convenience Receptacles in Residential Areas: Residential grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R; type as indicated on the drawings.
 3. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, , listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; type as indicated on the drawings.
 4. Tamper Resistant Convenience Receptacles: Residential grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, , listed and labeled as tamper resistant type; type as indicated on the drawings.
 5. Tamper Resistant and Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, , listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; type as indicated on the drawings.
 6. Combo USB type A/C tamper resistant, 15/20 Amp, Leviton T5663-W/T 5833-W.
- D. GFI Receptacles:
1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
 2. Standard GFI Receptacles: Residential grade, duplex, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R.
 3. Weather Resistant GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 4. Tamper Resistant GFI Receptacles: Residential grade, duplex, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, listed and labeled as tamper resistant type.
 5. Tamper Resistant and Weather Resistant GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
- E. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.

2.08 WALL PLATES

- A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com.
 2. Leviton Manufacturing Company, Inc.: www.leviton.com.
 3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us
 4. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
- B. All Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices, decorra style.

2. Size: Standard.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
 4. Provide screwless wallplates with concealed mounting hardware where indicated.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- E. Weatherproof Covers for Wet or Damp 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. Hubbell WP26M Series.

2.09 OCCUPANCY SENSORS

- A. Manufacturers:
1. Wattstopper: www.wattstopper.com. Part numbers indicated are Wattstopper; equals by other manufacturers are acceptable, unless otherwise noted.
 2. Hubbell Incorporated: www.hubbell-wiring.com.
 3. Sensor Switch: www.sensorswitch.com.
 4. Greengate: www.cooperindustries.com.
 5. Lutron Electronics Company, Inc.: www.lutron.com.
 6. Leviton Manufacturing Company, Inc.: www.leviton.com.
 7. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
- B. Sensors to be dual technology type with integral 24-volt dry contact for use with energy management system, unless otherwise indicated.
- C. Sensors to have manual-on operation.
- D. Sensors to be provided with coverage pattern and mounting as shown on drawings.
- E. The drawings show approximate locations of detectors and are diagrammatic only. Exact locations of detectors are to be field verified with the factory representative prior to mounting.
- F. Provide power pack as required for low voltage occupancy sensors. Wattstopper BZ-150 Series.
- G. Wall Switch:
1. Dual Technology: Wattstopper DW-100 Series.
 - a. Coverage area up to 1,000 sq. ft. with 180 degrees field of view.
 2. Passive Infrared: Wattstopper WS-250 Series.
 - a. Coverage area up to 900 sq. ft. with 180 degrees field of view.
 3. Ultrasonic: Wattstopper UW-100 Series.
 - a. Coverage area up to 400 sq. ft. with 180 degrees field of view.
- H. Ceiling Mount (360 degrees):
1. Dual Technology: Wattstopper DT-300 Series.
 - a. Coverage area up to 1,000 sq. ft. with 360 degrees field of view.
 2. Passive Infrared: Wattstopper CI-300 Series.
 - a. Coverage area up to 1,200 sq. ft. with 360 degrees field of view.
 3. Ultrasonic: Wattstopper VT300-3 Series.
 - a. Coverage area up to 2,000 sq. ft. with 360 degrees field of view.
- I. Ceiling/Wall Mount (Directional):
1. Dual Technology: Wattstopper DT-200 Series.
 - a. Coverage area up to 2,000 sq. ft..
 2. Passive Infrared: Wattstopper CX-100 Series.
 - a. Coverage area up to 1,000 sq. ft.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- 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 floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that openings in access floor are in proper locations.
- H. 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 a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
 - 1. Mounting Heights: As indicated on the drawings.
 - 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.
 - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- 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. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal or inserting conductor screw-actuated in binding clamp 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.
- F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- G. Unless otherwise indicated, GFI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFI protection.
- H. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- 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. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.
- M. 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.
- N. 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. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.
- 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.

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

**SECTION 26 28 13
FUSES AND CIRCUIT BREAKERS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fuses.
- B. Circuit breakers.

1.02 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide data sheets showing electrical characteristics, including time-current curves.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 63 00 - Product Substitution Procedures Requirements, for additional provisions.
 - 2. Extra Fuses: Three of each type and size.
 - 3. Fuse Pullers: Two.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Fuses:
 - 1. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.
 - 2. Ferraz Shawmut, Inc.: www.ferrazshawmut.com.
 - 3. Littelfuse, Inc: www.littelfuse.com.
- B. Circuit Breakers:
 - 1. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
 - 2. General Electric Company: www.geindustrial.com.
 - 3. Schneider Electric; Square D Products: www.schneider-electric.us.
 - 4. Siemens: www.sea.siemens.com.

2.02 FUSES - GENERAL

- A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- B. Voltage: Rating suitable for circuit phase-to-phase voltage.
- C. Main Service Switches Larger than 600 amperes: Class L (time delay).
- D. Main Service Switches: Class RK1 (time delay).
- E. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).
- F. Power Load Feeder Switches: Class RK1 (time delay) or J (time delay).
- G. Motor Load Feeder Switches: Class RK1 (time delay) or J (time delay).

2.03 CLASS RK1 (TIME DELAY) FUSES

- A. Manufacturers:
 - 1. Bussmann LPS-RK (600V) or LPN-RK (250V): www.bussmann.com.
 - 2. Ferraz Shawmut: www.ferrazshawmut.com.
 - 3. Littelfuse: www.littelfuse.com.

2.04 CLASS J (TIME DELAY) FUSES

- A. Manufacturers:
 - 1. Bussmann LPJ-SP: www.bussmann.com.
 - 2. Ferraz Shawmut: www.ferrazshawmut.com.
 - 3. Littelfuse: www.littelfuse.com.

2.05 CLASS L (TIME DELAY) FUSES

- A. Manufacturers:
 - 1. Bussmann KRP-C: www.bussmann.com.
 - 2. Ferraz Shawmut: www.ferrazshawmut.com.
 - 3. Littelfuse: www.littelfuse.com.

2.06 CIRCUIT BREAKERS

- A. Circuit breakers shall be molded case, bolt-on, trip free, quick make, quick break, thermal magnetic type.
- B. Circuit breakers shall be calibrated to carry 80% rated current in an ambient temperature of 40 degrees C.
- C. Handles shall clearly indicate rating and position "On", "Off", or "Tripped".
- D. Multi-pole circuit breakers shall be common trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously.
- E. Circuit breakers shall have an interrupting rating not less than the available fault duty at the breaker. Minimum rating shall be 10,000A for 250 volt panels. Circuit breakers shall be fully rated to exceed the available 3 phase fault current.
- F. Circuit breakers shall be switch duty rated and full size, tandem units are not approved.
- G. Provide with handle "lock-on" device for breakers serving time switches, night lights, emergency lighting unit equipment, fire alarm, security, data racks, servers, and other circuits as identified on the drawings.
- H. Provide combination circuit breakers and ground fault interrupters where indicated on the drawings or required by the National Electrical Code.
- I. All circuit breakers rated 250A and above shall be provided with adjustable magnetic trip elements.
- J. Circuit breakers shall conform to NEMA standard AB1.
- K. Provide products suitable for use as service entrance equipment where applicable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- B. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.
- C. Install enclosed circuit breakers plumb. Provide support and labeling in accordance with these specifications.
- D. In dwelling areas, as required by NEC 210.12, provide arc-fault circuit breakers to protect all branch circuits such that the complete circuit is protected.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Inspect and test each circuit breaker.
- C. Inspect each circuit breaker visually.
- D. Perform several mechanical ON-OFF operations on each circuit breaker.
- E. Verify circuit continuity on each pole in closed position.
- F. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB 1 requirements.
- G. Include description of testing and results in test report.

3.03 ADJUSTING

- A. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.
- B. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION

SECTION 26 32 13
ENGINE GENERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator system and associated components and accessories:
 - 1. Engine and engine accessory equipment.
 - 2. Alternator (generator).
 - 3. Generator set control system.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 22 11 13 - Facility Fuel-Oil Piping:
 - 1. Diesel fuel piping.
- C. Section 23 31 00 - HVAC Ducts and Casings.
- D. Section 23 51 00 - Breechings, Chimneys, and Stacks: Engine exhaust piping.
- E. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- F. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- G. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. ASTM D975 - Standard Specification for Diesel Fuel.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NECA/EGSA 404 - Standard for Installing Generator Sets.
- D. NEMA MG 1 - Motors and Generators.
- E. NFPA 30 - Flammable and Combustible Liquids Code.
- F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
- G. NFPA 70 - National Electrical Code.
- H. NFPA 99 - Health Care Facilities Code.
- I. NFPA 110 - Standard for Emergency and Standby Power Systems.
- J. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids.
- K. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries.
- L. UL 2200 - Stationary Engine Generator Assemblies.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.

2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

1.05 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
 1. Include generator set sound level test data.
 2. Include characteristic trip curves for overcurrent protective devices upon request.
 3. Include alternator thermal damage curve upon request.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- D. Derating Calculations: Indicate ratings adjusted for applicable service conditions.
- E. Fuel Storage Tank Calculations: Indicate maximum running time for generator set configuration provided.
- F. Specimen Warranty: Submit sample of manufacturer's warranty.
- G. Evidence of qualifications for installer.
- H. Evidence of qualifications for maintenance contractor (if different entity from installer).
- I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- J. Manufacturer's factory emissions certification.
- K. Manufacturer's certification that products meet or exceed specified requirements.
- L. Source quality control test reports.
- M. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
 1. Certified prototype tests.
 2. Torsional vibration compatibility certification.
 3. NFPA 110 compliance certification.
 4. Certified rated load test at rated power factor.
- N. Manufacturer's detailed field testing procedures.
- O. Field quality control test reports.

- P. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- Q. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- R. Maintenance contracts.
- S. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.
- T. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Fuses: One of each type and size.
 - 3. Extra Filter Elements: One of each type, including fuel, oil and air.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
 - 2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
 - 3. NFPA 99 (Health Care Facilities Code).
 - 4. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
 - 5. NFPA 30 (Flammable and Combustible Liquids Code).
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
 - 1. Authorized service facilities located within 200 miles of project site.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.
- E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
 - 1. Contract maintenance office located within 200 miles of project site.
- 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. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.
- 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 instructions to avoid damage to generator set components, enclosure, and finish.

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 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Packaged Engine Generator Set:
 - 1. Caterpillar Inc.
 - 2. Cummins Power Generation Inc.
 - 3. Generac Power Systems.
 - 4. Kohler Co.
 - 5. MTU Onsite Energy.
- B. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:
 - 1. Application: Emergency/standby.
 - 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
- D. Packaged Engine Generator Set:
 - 1. Type: Diesel (compression ignition).
 - 2. Power Rating: As indicated on drawings, standby.
 - 3. Voltage: As indicated on drawings.
- E. Generator Set General Requirements:
 - 1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
 - 2. Factory-assembled, with components mounted on suitable base.
 - 3. List and label engine generator assembly as complying with UL 2200.
 - 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
 - 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
- F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

- G. Starting and Load Acceptance Requirements:
1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
 4. Maximum Load Step: Supports 100 percent of rated load in one step.
 - a. Maximum Voltage Deviation with Load Step: 15 percent.
 - b. Maximum Frequency Deviation with Load Step: 2 percent.
- H. Exhaust Emissions Requirements:
1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.
- I. Sound Level Requirements:
1. Do not exceed 71 dBA when measured at 23 feet from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.
 2. Comply with applicable noise level regulations.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

- A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- B. Engine Fuel System - Diesel (Compression Ignition):
1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
 2. Fuel Storage: Sub-base fuel tank.
 3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
 4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
 5. Sub-Base Fuel Tank:
 - a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
 - b. Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
 - c. Features:
 - 1) Direct reading fuel level gauge.
 - 2) Normal atmospheric vent.
 - 3) Emergency pressure relief vent.
 - 4) Fuel fill opening with lockable cap.
 - 5) Dedicated electrical conduit stub-up area.
 - 6) Low fuel level switch.
 - 7) Leak detection switch; located within secondary containment interstitial space for detection of primary tank fuel leak.

- C. Engine Starting System:
1. System Type: Electric, with DC solenoid-activated starting motor(s).
 2. Battery(s):
 - a. Battery Type: Lead-acid.
 - b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
 - c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
 3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
 4. Battery Charger:
 - a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
 - b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
 - c. Recognized as complying with UL 1236.
 - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
 - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
 - f. Provide alarm output contacts as necessary for alarm indications.
- D. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- E. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
- F. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
 2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
 3. Ducted Radiators: Where ducted radiator air discharge is to be field-installed, provide suitable radiator duct flange/adapter.
- G. Engine Air Intake and Exhaust System:
1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
 2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

2.04 ALTERNATOR (GENERATOR)

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

- B. Exciter:
 - 1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
 - 2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
 - 3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.
- E. Enclosure: NEMA MG 1, drip-proof.
- F. Total Harmonic Distortion: Not greater than five percent.

2.05 GENERATOR SET CONTROL SYSTEM

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
 - 1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
 - 2. Generator Set Control Functions:
 - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
 - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
 - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
 - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
 - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
 - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
 - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
 - 3. Generator Set Status Indications:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase.
 - c. Frequency (Hz).
 - d. Real power (W/kW).
 - e. Reactive power (VAR/kVAR).
 - f. Apparent power (VA/kVA).
 - g. Power factor.
 - h. Duty Level: Actual load as percentage of rated power.
 - i. Engine speed (RPM).
 - j. Battery voltage (Volts DC).
 - k. Engine oil pressure.
 - l. Engine coolant temperature.
 - m. Engine run time.
 - n. Generator powering load (position signal from transfer switch).
 - 4. Generator Set Protection and Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:

- 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (warning).
 - 6) Low oil pressure (shutdown).
 - 7) Overspeed (shutdown).
 - 8) Low fuel level (warning).
 - 9) Low coolant level (warning/shutdown).
 - 10) Generator control not in automatic mode (warning).
 - 11) High battery voltage (warning).
 - 12) Low cranking voltage (warning).
 - 13) Low battery voltage (warning).
 - 14) Battery charger failure (warning).
- b. In addition to NFPA 110 requirements, provide the following protections/indications:
- 1) High AC voltage (shutdown).
 - 2) Low AC voltage (shutdown).
 - 3) High frequency (shutdown).
 - 4) Low frequency (shutdown).
 - 5) Overcurrent (shutdown).
 - 6) Fuel tank leak (warning), where applicable.
- c. Provide contacts for local and remote common alarm.
- d. Provide lamp test function that illuminates all indicator lamps.
5. Other Control Panel Features:
- a. Event log.
 - b. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
 - c. Remote monitoring capability via PC.

2.06 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.
- C. Generator Set production testing to include, at a minimum:
 1. Operation at rated load and rated power factor.
 2. Single step load pick-up.
 3. Transient and steady state voltage and frequency performance.
 4. Operation of safety shutdowns.
- D. Diesel Fuel Storage Tanks: Perform pressurized leak test prior to shipment.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.

- D. Verify that mounting surfaces are ready to receive equipment.
- 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. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch high concrete pad constructed in accordance with Section 03 30 00.
- F. Provide required support and attachment in accordance with Section 26 05 29.
- G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
- H. Provide diesel fuel piping and venting in accordance with Section 22 11 13, where not factory installed.
- I. Provide duct for cooling air intake/exhaust in accordance with Section 23 31 00.
- J. Provide engine exhaust piping in accordance with Section 23 51 00, where not factory installed.
 - 1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
 - 2. Do not exceed manufacturer's maximum back pressure requirements.
- K. Provide grounding and bonding in accordance with Section 26 05 26.
- L. Identify system wiring and components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
- D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- F. Preliminary inspection and testing to include, at a minimum:
 - 1. Inspect each system component for damage and defects.
 - 2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
 - 3. Check for proper oil and coolant levels.
- G. Prepare and start system in accordance with manufacturer's instructions.
- H. Perform acceptance test in accordance with NFPA 110.
- I. Inspection and testing to include, at a minimum:

1. Verify compliance with starting and load acceptance requirements.
2. Verify voltage and frequency; make required adjustments as necessary.
3. Verify phase sequence.
4. Verify control system operation, including safety shutdowns.
5. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).
6. Perform load tests in accordance with NFPA 110 (1.5 hour building load test followed by 2 hour full load test).

- J. Provide field emissions testing where necessary for certification.
- K. Sound Level Tests: Measure sound levels for compliance with specified requirements. Identify and report ambient noise conditions.
- L. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Provide minimum of four hours of training.
 3. Instructor: Manufacturer's authorized representative.
 4. Location: At project site.
- E. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters and fill fuel storage tank.

3.06 PROTECTION

- A. Protect installed engine generator system from subsequent construction operations.

3.07 MAINTENANCE

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.
- C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.
- D. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 4 hours of notification.

2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION

**SECTION 26 32 13
ENGINE GENERATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator set.
- B. Engine mount radiator.
- C. Exhaust silencer and fittings.
- D. Fuel tank.
- E. Remote annunciator panel.
- F. Battery and charger.
- G. Remote fuel fill station.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
 - 1. Section 22 07 19 - Plumbing Piping Insulation.
 - 2. Section 23 11 13 - Facility Fuel-Oil Piping:
 - 3. Diesel fuel piping.
 - 4. Section 23 31 00 - HVAC Ducts and Casings.
 - 5. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 6. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 53 - Electrical Identification: Identification products and requirements.
- D. Section 26 36 00 - Transfer Switches.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.
 - 1. NEMA MG 1 - Motors and Generators; 2017.
 - 2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- C. NFPA 30 - Flammable and Combustible Liquids Code; 2018.
 - 1. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2018.
 - 2. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 99 - Health Care Facilities Code; 2017.
- E. NFPA 110 - Standard for Emergency and Standby Power Systems; 2016.
- F. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.
 - 1. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.
- G. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.

2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories 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 30 00 - Administrative Requirements, for submittal procedures.
 1. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
 2. Certified prototype tests.
 3. Torsional vibration compatibility certification.
 4. NFPA 110 compliance certification.
 5. Certified rated load test at rated power factor.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection diagrams.
- C. Product Data: Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, remote radiator, remote fuel fill station, and weather proof enclosures.
 1. Test Reports: Indicate results of performance testing.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 1. Manufacturer's Field Reports: Indicate procedures and findings.
- F. Operation Data: Include instructions for normal operation.
- G. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.
- H. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 1. Extra Filter Elements: Two of each type, including fuel, oil and air.
 2. Tools: One set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal tool box.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 1. NFPA 70 (National Electrical Code).
 2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
 3. NFPA 101.

4. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
 5. NFPA 30 (Flammable and Combustible Liquids Code).
 - a. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
 6. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience with service facilities within 50 miles of Project.
1. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years experience.
- C. Products: Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept unit on site on skids. Inspect for damage.
1. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Caterpillar Inc.: www.caterpillar.com.
- B. MTU.
- C. Generac: www.generac.com.
 1. Cummins : www.cummins.com.
- D. Kohler: www.kohler.com.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:
 1. Application: Emergency/standby.
 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
 3. Packaged Engine Generator Set:
 4. Type: Diesel (compression ignition).
 5. Power Rating: As determined by design-build contractor.
 6. Voltage: 120/208V, 3 ph, 4-wire.
- D. Generator Set General Requirements:
 1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
 2. Factory-assembled, with components mounted on suitable base.
 3. List and label engine generator assembly as complying with UL 2200.
 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.

- E. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
- F. Starting and Load Acceptance Requirements:
 - 1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
 - 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
 - 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
 - 4. Maximum Load Step: Supports 100 percent of rated load in one step.
- G. Exhaust Emissions Requirements:
 - 1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
 - 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.
- H. System Capacity: As indicated on drawings at elevation of 500 feet above sea level, standby rating using engine-mounted radiator.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

- A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- B. Engine Fuel System - Diesel (Compression Ignition):
 - 1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
 - 2. Fuel Storage: Sub-base fuel tank.
 - 3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
 - 4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
 - 5. Sub-Base Fuel Tank:
 - a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
 - b. Tank Capacity: Size for minimum of 12 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
 - c. Features:
 - 1) Direct reading fuel level gauge.
 - 2) Normal atmospheric vent.
 - 3) Emergency pressure relief vent.
 - 4) Fuel fill opening with lockable cap.
 - 5) Dedicated electrical conduit stub-up area.
- C. Engine Starting System:
 - 1. System Type: Electric, with DC solenoid-activated starting motor(s).

2. Battery(s):
 - a. Battery Type: Lead-acid.
 - b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
 - c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:
 - a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
 - b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
 - c. Recognized as complying with UL 1236.
 - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
 - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
 - f. Provide alarm output contacts as necessary for alarm indications.
- D. Engine Speed Control System (Governor):
 1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- E. Engine Lubrication System:
 1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
- F. Engine Cooling System:
 1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
 2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
- G. Engine Air Intake and Exhaust System:
 1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
 2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
- H. Governor: Isochronous type to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. .
 1. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 120 volts AC.

- I. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F. Radiator air flow restriction 0.5 inches of water maximum.

2.04 ALTERNATOR (GENERATOR)

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:
 1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
 2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
 3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.
 1. Enclosure: NEMA MG 1, drip-proof.
- E. Total Harmonic Distortion: Not greater than five percent.
- F. Rating: kW as indicated on drawings, at 0.8 power factor, voltage as indicated on drawings, 60 Hz at 1800 rpm.

2.05 GENERATOR SET CONTROL SYSTEM

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
 1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
 2. Generator Set Control Functions:
 - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
 - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
 - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
 - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
 - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
 - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
 - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
 3. Generator Set Status Indications:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase.
 - c. Frequency (Hz).
 - d. Real power (W/kW).
 - e. Reactive power (VAR/kVAR).
 - f. Apparent power (VA/kVA).
 - g. Power factor.
 - h. Duty Level: Actual load as percentage of rated power.

- i. Engine speed (RPM).
- j. Battery voltage (Volts DC).
- k. Engine oil pressure.
- l. Engine coolant temperature.
- m. Engine run time.
- n. Generator powering load (position signal from transfer switch).
- 4. Generator Set Protection and Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).
 - 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).
 - b. In addition to NFPA 110 requirements, provide the following protections/indications:
 - 1) High AC voltage (shutdown).
 - 2) Low AC voltage (shutdown).
 - 3) High frequency (shutdown).
 - 4) Low frequency (shutdown).
 - 5) Overcurrent (shutdown).
 - c. Provide contacts for local and remote common alarm.
 - d. Provide lamp test function that illuminates all indicator lamps.
- 5. Other Control Panel Features:
 - a. Event log.

2.06 ACCESSORIES

- A. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.
- B. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.
- C. Line Circuit Breaker: Adjustable trip, molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole, sized in accordance with NFPA 70; UL listed. Include battery-voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in enclosure to meet NEMA 250, Type 1 requirements. Coordinate with electrical system per NEC 700.28 and 701.27.
- D. Remote Annunciator Panel: Flush mounted panel with painted finish. Provide alarm horn, and indicators and alarms as follows:
 - 1. High battery voltage (alarm).
 - 2. Low battery voltage (alarm).
 - 3. Low fuel (alarm).

4. System ready.
 5. Anticipatory-high water temperature.
 6. Anticipatory-low oil pressure.
 7. Low coolant temperature.
 8. Switch in off position (alarm).
 9. Overcrank (alarm).
 10. Emergency stop (alarm).
 11. High water temperature (alarm).
 12. Overspeed (alarm).
 13. Low oil pressure (alarm).
 14. Line power available.
 15. Generator power available.
 16. Lamp test and horn silence switch.
- E. Weather-Protective Enclosure: Sound attenuated, reinforced steel housing allowing access to control panel and service points, with lockable doors and panels. Include fixed louvers, battery rack, and silencer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
 1. Arrange equipment to provide minimum clearances and required maintenance access.
 2. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch high concrete pad constructed in accordance with Section 03 30 00.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
 1. Provide diesel fuel piping and venting in accordance with Section 23 11 13, where not factory installed.
 2. Provide engine exhaust piping in accordance with Section 23 51 00, where not factory installed.
 3. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
 4. Do not exceed manufacturer's maximum back pressure requirements.
- F. Provide grounding and bonding in accordance with Section 26 05 26.
- G. Identify system wiring and components in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- E. Preliminary inspection and testing to include, at a minimum:
 1. Inspect each system component for damage and defects.

2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
3. Check for proper oil and coolant levels.
4. Prepare and start system in accordance with manufacturer's instructions.
- F. Perform acceptance test in accordance with NFPA 110.
- G. Provide field emissions testing where necessary for certification.
- H. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- I. Provide the services of manufacturer's representative to prepare and start system.
 1. Provide full load test utilizing portable test bank, if required, for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal. Provide fuel required for testing.
- J. Record in 20 minute intervals during four hour test:
 1. Kilowatts.
 2. Amperes.
 3. Voltage.
 4. Coolant temperature.
 5. Room temperature.
 6. Frequency.
 7. Oil pressure.

3.03 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate operation to Owner's operating personnel:
 1. Describe loads connected to emergency and standby system and restrictions for future load additions.
 2. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency and standby power.
- B. Fill fuel tank to full level at Substantial Completion.

3.05 MAINTENANCE

- A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.
- B. Provide service and maintenance of engine generator for one year from Date of Substantial Completion.

END OF SECTION

SECTION 26 33 23
CENTRAL BATTERY EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Uninterruptible power supply (UPS) centralized emergency lighting inverters.
- B. Controls.
- C. Battery charger.
- D. Storage batteries.
- E. Cabinet.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 51 00 - Interior Lighting:

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code.
- B. NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems.

1.04 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittal procedures.
- B. Shop Drawings.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
- D. Shop Drawings: Indicate dimensions, input/output voltages, power ratings, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, and installed features and accessories.
- 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 operation of product.
- F. Manufacturer's certification that products meet or exceed specified requirements.
- G. Manufacturer's detailed field testing procedures.
- H. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- 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 instructions to avoid damage to inverter system components, enclosure, and finish.
- D. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

1.07 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

- A. Inverter Assemblies: Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- B. Batteries: Provide pro-rata warranty for the duration of rated design life.

1.09 WARRANTY

- A. Include with the power supply submittal drawings a warranty of one year on the central battery equipment unit and a separate 6-year warranty on life and performance on the battery supplied by the battery manufacturer. Warranties shall be written on the manufacturer's letterhead and signed by a corporate officer.
- B. Warranty includes the following:
 - 1. Equipment complies with the latest adopted National Electrical Code.
 - 2. The complete assembly will provide its full rated output under normal operation for 90 minutes at any time throughout the 1-year warranty period.
 - 3. Indicate the battery manufacturer and warrant each individual battery for 6 years under normal operation. A battery will be considered to have failed when it does not provide 80 percent of its initial ampere-hour capacity.
 - 4. Each power supply shall be factory tested under full load operating conditions.

PART 2 PRODUCTS

2.01 CENTRALIZED EMERGENCY LIGHTING INVERTERS - GENERAL REQUIREMENTS

- A. Automatic Sequence of Operations:
- B. Acuity Brands, Inc
- C. Cooper Lighting, a division of Cooper Industries.
- D. Hubbell Lighting, Inc.
- E. Philips Chloride.
- F. Myers.

- G. Perfect Power.
- H. Crucial Power Products.
- I. Exide.
- J. Description: Emergency power supply system designed for Level 1 applications and consisting of rectifier/charger unit, storage battery, and solid state inverter with mechanical transfer switch, in one or several enclosures. Provide unit suitable for operating HID lamps without extinguishing lamp on transfer.
- K. Provide full output for 90 minutes of operation.
- L. Transfer module shall automatically transfer the emergency system loads to the output power modules within 500 milliseconds of normal power failure. Upon restoration of normal power, provide a delay of return to normal power to assure an in-phase transfer. In the event of a prolonged outage, the power modules will be removed from the line when the batteries discharge to nominally 87 percent of full charge voltage.
- M. Provide with the following features: Overload capacity of 125 percent for 5 minutes, low voltage battery disconnect, short circuit proof, current limiting, fused battery circuit, reverse polarity, brownout protection.
- N. Microprocessor Control Unit:

2.02 CONTROLS

- 1. Instruments, controls, indicating lights and LCD display screen factory mounted on the front of the cabinet for easy monitoring and operation without requiring access to the interior.
 - 2. Control panel contains AC line switch, charging indicating light, test switch, AC output voltmeter, DC voltmeter, DC ammeter, electrolyte level alarm. When fuses or breakers are used to protect components, visual alarms provided on the control panel indicate tripped conditions.
 - 3. Automatic monthly and annual self-testing ability.
 - 4. Continuous self-diagnostic and self-testing system.
 - 5. Provide with the following alarm functions: high/low battery charger fault, near low battery, low battery, load reduction fault, output overload, high/low AC input volts, high ambient temperature, inverter fault, output fault and circuit breaker trip.
 - 6. Class C auxiliary contacts to indicate when unit has transferred to the battery source.
- B. Battery charger module solid state microprocessor controlled, capable of fully recharging the batteries within listed UL requirements.

2.03 BATTERY CHARGER

- A. Charger constantly monitors the batteries, providing automatic discharge and charge only when needed.
- B. Internally protects against short circuits and automatically recovers to charge batteries when the fault is removed.
- C. Sealed, maintenance free lead-calcium type, series and parallel connected.

2.04 STORAGE BATTERIES

- A. Battery cases impact resistant with vapor-tight removable caps and lead connectors integrally molded into the cover.
- B. Equip batteries with an electrolyte level sensing device to alarm upon low liquid level.
- C. Rated for an operating temperature limit of a minimum 32 degrees F and maximum of 100 degrees F.

- D. Mount components in one or more freestanding metal cabinets of sufficient strength to handle the weight of the components.

2.05 CABINET

- A. Durable finish, factory applied, NEMA 1 rating, 14 gauge steel with hinged lockable doors.
- B. Provide either a cabinet for combined inverter unit with battery storage or separate inverter and battery cabinets, depending upon unit rating.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSPECTION

- A. After the equipment has arrived at the job site, the Owner (or the Owner's representative), Contractor, and Manufacturer's representative will perform a visual inspection for physical damage and compare nameplate data with drawings and specifications. Manufacturer to correct problems encountered.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install inverter assemblies in accordance with applicable requirements of NECA 416.
- C. Install products in accordance with manufacturer's instructions.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install inverter assemblies plumb and level.
- G. Unless otherwise indicated, mount floor-mounted inverter assemblies on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- H. Provide grounding and bonding in accordance with Section 26 05 26.

3.04 FIELD QUALITY CONTROL

- A. Perform the following inspections and test procedures by factory-trained field service personnel prior to equipment system start-up:
 - 1. Visual Inspection:
 - a. Inspect equipment for signs of damage.
 - b. Verify installation per drawings.
 - c. Inspect cabinets for foreign objects.
 - d. Verify neutral and ground conductors are properly sized and configured.
 - e. Inspect cell cases.
 - f. Inspect each cell for proper polarity.
 - g. Verify printed circuit boards are configured properly.
 - 2. Mechanical Inspection:
 - a. Check control wiring connections for tightness.
 - b. Check power wiring connections for tightness.
 - c. Check terminal screws, nuts, and/or spade lugs for tightness.
 - 3. Electrical Inspection:
 - a. Check fuses for continuity.
 - b. Confirm input voltage and phase rotation is correct.
 - c. Verify control transformer connections are correct for voltages being used.

- d. Assure connection and voltage of the battery string(s).

3.05 UNIT START-UP TESTING

- A. Provide factory trained field service personnel to perform the following functional testing operations during start-up of the unit:
1. Energize control power.
 2. Perform control/logic checks and adjust to meet specification.
 3. Verify DC float and equalize voltage levels.
 4. Verify DC voltage clamp and overvoltage shutdown levels.
 5. Verify battery discharge, low battery warning and low battery shutdown levels.
 6. Verify fuse monitor alarms and system shutdown.
 7. Verify inverter voltages and regulation circuits.
 8. Verify inverter/bypass sync circuits and set overlap time.
 9. Perform manual transfers and returns.
 10. Simulate utility outage.
 11. Verify proper recharge.

3.06 MANUFACTURER'S FIELD SERVICE

- A. Service Personnel:
1. Nationwide service organization, consisting of factory-trained field service personnel dedicated to the start-up and maintenance of central battery equipment.
 2. Provide a national dispatch center to coordinate field service personnel schedules. One toll-free number reaches a qualified support person 24 hours/day, 7 days/week, 365 days/year. If emergency service is required, telephone response time is 20 minutes or less and on-site response time is four hours or less.
 3. Assign two local customer engineers to the site with a regional office as a backup.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Training: Train Owner's personnel on operation, adjustment, and maintenance of emergency lighting inverter system.

3.08 MAINTENANCE

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide trouble call-back service upon notification by Owner:

END OF SECTION

SECTION 26 33 43

VEHICLE CHARGING EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Vehicle Charging Stations

1.02 REFERENCES

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- B. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components.
- C. NFPA 5000 - Building Construction and Safety Code.
- D. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.
- E. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.
- F. ASCE: American Society of Civil Engineers
 - 1. ASCE 7 Minimum Design Loads for Buildings and Other Structures
- G. ICC: International Code Council
 - 1. ICC-ES AC 156 Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components
- H. NEMA National Electrical Manufacturers Association
- I. NFPA National Fire Protection Agency
 - 1. NFPA 70: National Electrical Code (NEC)
 - 2. NFPA 5000: Building Construction and Safety Code
- J. SAE: SAE International
- K. UL: Underwriters Laboratories
 - 1. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations
 - 2. UL 50E Enclosures for Electrical Equipment, Environmental Considerations
 - 3. UL 355 Standard for Cord Reels
 - 4. UL 2594 Standard for Electric Vehicle Supply Equipment

1.03 SUBMITTALS

- A. Submit product data, shop drawings, wiring diagrams and samples.
- B. Operation and maintenance manuals.
- C. Warranty information.

1.04 WARRANTY

- A. Standard manufacturer 5 year warranty of the charging equipment and 18 month warranty of the cord reel system.

1.05 QUALITY ASSURANCE

- A. Provide EVSE components, hardware, software, and parts necessary for the work described in this Section.

- B. EVSE electrical components, enclosures, and mounting systems UL listed or approved.
- C. List and label electrical components, devices, and accessories as defined in NEC article 100.
- D. EVSE equipment complies with seismic requirement NFPA 5000, ASCE 7, ICC-ES AC156, and ICC, as applicable.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Pow-R-Station
- B. G.E. WattStation
- C. Hubbell PEP Station
- D. Schneider Electric/Square-D EVlink
- E. Siemens VersiCharge
- F. Chargepoint
- G. EV Solutions
- H. Telefonix
- I. Or Pre bid Approved

2.02 VEHICLE CHARGING STATIONS

- A. SAE Level 1 compliant rating.
- B. Rated for commercial use and UL 2594 certified for EVSE commercial use.
- C. Dual port and provided with power sharing software.
- D. Housing:
 - 1. Pedestal mount, powder coated aluminum and UV resistant plastic, weatherproof housing, UL 50 and UL 50E and NEMA type 3R rated.
 - 2. Exterior Use: Suitable protection against rain, sleet, and damage from external ice formation.
- E. Charging Cord: 14 foot retractable cord reel storage inside of the charging station unit. Cord reel is capable of temporary submersion and UL 355 listed.
- F. Charging Connector: SAE J1772 Compliant.
- G. User Interface: LED interface panel, with indicators for power status, charging in progress, cord connected to vehicle, out of service.
- H. Input/output protection: integral branch circuit protection as required by the NEC. Circuit breakers have a UL listed interrupting rating sufficient for the application.
- I. Equipped with leakage and ground current protection.
- J. Power source: 208vac,30A, designed to be connected to a 40A circuit.
- K. Temperature rating: -30 degrees Celsius to +50 degrees Celsius.
- L. Concrete Mounting Pad: Provide concrete meeting the requirements of Division 03, Concrete and the manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Visually inspect the charging station for shipping damage upon arrival. Protect the charging station from damage during job site storage, installation and from other construction activities until the project completion.
- B. Provide a concrete mounting pad for each vehicle charging station. Extend at grade level a minimum of 6-inches on all sides of the charging station. The top of the concrete mounting pad 2-inches above grade where located in a landscaping area or flush with grade where located in an asphalt finished parking area or concrete walkway.
- C. Conduits for the power and data source routed underground and concealed into the bottom of the charging unit in the location recommended by the manufacture.
- D. Provide equipment anchors as recommended by the manufacture to attach the charging station to the concrete mounting pad.
- E. Mount the charging station plumb vertical position.
- F. Provide power connections to the charging unit input wiring terminals as recommended by the manufacture.
- G. Install housing components and fasteners as recommended in the manufacturer's installation manual for a complete installation.

3.02 COORDINATION

- A. The electrical drawings indicate the approximate location of devices. Refer to architectural and civil elevations, sections, and details for exact locations.

3.03 FIELD TESTING

- A. Test the charging power cord reel full length pull out, cord latch catch mechanism, and complete retraction back into the charging station cabinet.
- B. Verify LED status indication status lights are functioning per manufactures directions.
- C. Visually inspect cabinet exterior surfaces, surface scratch free and new in appearance.
- D. Follow the manufacturer's instructions for connection to a vehicle and check for correct functioning.

3.04 TRAINING

- A. Provide training for the Owner's maintenance personal on procedures and related startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- B. Review data in the operation and maintenance manuals with the Owner.

END OF SECTION

**SECTION 26 36 00
TRANSFER SWITCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
- B. Automatic Transfer Switch.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Electrical Identification: Identification products and requirements.
- E. Section 26 32 13 - Engine Generators: Testing requirements.

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); 2014.
- C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2005, with Errata (2006).
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.
- C. 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.
- D. Operation Data: Instructions for operating equipment under emergency conditions.
- E. Maintenance Data: Routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.05 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- C. Conform to requirements of NFPA 70.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- E. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years experience.
- F. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ASCO Power Technologies, LP: www.asco.com.
- B. Caterpillar: www.cat.com.
- C. Generac: www.generac.com.
- D. Cummins.
- E. MTU.
- F. Kohler.
- G. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRANSFER SWITCHES

- A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.
- D. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).
- E. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.
- F. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.
- G. Switching Methods:
 - 1. Obtain control power for transfer operation from line side of source to which the load is to be transferred.
- H. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.
- I. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Finish: Manufacturer's standard unless otherwise indicated.

2.03 AUTOMATIC TRANSFER SWITCH

- A. Description: NEMA ICS 10, automatic transfer switch .
- B. Configuration: Electrically operated, mechanically held transfer switch.
- C. Interrupting Capacity: 100 percent of continuous rating.
- D. Withstand Current Rating: To meet available 3 phase fault current.
- E. Open Transition:
 - 1. The transfer switch shall operate as a conventional break-before-make (open transition) switch.

2.04 COMPONENTS

- A. Test Switch: Mount in cover of enclosure to simulate failure of normal source.
- B. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.
- C. Transfer Switch Auxiliary Contacts: 1 normally open; 1 normally closed.

- D. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.
- E. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.
- F. Number of poles as indicated on drawings.
- G. Enclosure: ICS 10, Type 1, finished with manufacturer's standard enamel finish.

2.05 AUTOMATIC SEQUENCE OF OPERATION

- A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
- B. Time Delay To Start Alternate Source Engine Generator: 0 to 30 seconds, adjustable.
- C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
- D. Time Delay Before Transfer to Alternate Power Source: 0 to 30 seconds, adjustable.
- E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
- F. Time Delay Before Transfer to Normal Power: 0 to 30 seconds, adjustable; bypass time delay in event of alternate source failure.
- G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.
- H. Engine Exerciser: Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.
- I. Alternate System Exerciser: Transfer load to alternate source during engine exercising period.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive transfer switches.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide housekeeping pads under the provisions of Section 03 30 00.

3.03 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 and required maintenance access.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Install transfer switches plumb and level.
- F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- G. Provide grounding and bonding in accordance with Section 26 05 26.
- H. Identify transfer switches and associated system wiring in accordance with Section 26 05 53.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

- D. Provide the services of the manufacturer's technical representative to check out transfer switch connections and operation and place in service.
- E. Perform field inspection and testing in accordance with Section 01 40 00.
- F. Inspect and test in accordance with NETA STD ATS, except Section 4.
- G. Perform inspections and tests listed in NETA STD ATS, Section 7.22.3.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate operation of transfer switch in normal and emergency modes.

3.06 MAINTENANCE

- A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.
- B. Provide service and maintenance of transfer switches for one year from Date of Substantial Completion.

END OF SECTION

SECTION 26 43 00

SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for distribution locations.
- B. Surge protective devices for branch panelboard locations.

1.02 SUMMARY

- A. Surge Protective Devices (SPD) for low voltage power equipment and provide effective high energy protection against transient surges, temporary over-voltages, voltage swells and high frequency noise attenuation.
- B. This Section describes the materials and installation requirements for Surge Protective Devices (SPD). SPD's are used for the protection of AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.
- C. This specification also describes the mechanical and the electrical requirements for the SPD. Suitable for application in both category B and C environments as described in ANSI/IEEE C62.41- 2002.
- D. Furnish and install the Surge Protective Devices having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract documents. Provide related hardware (i.e. flush mounting kits, mounting brackets, etc.) as required for the installation of the SPD system suitable for the application.

1.03 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 23 00 - Low-Voltage Switchgear.
- C. Section 26 24 13 - Switchboards.
- D. Section 26 24 16 - Panelboards.
- E. Section 26 24 19 - Motor-Control Centers.
- F. Section 26 25 13 - Low-Voltage Busways.

1.04 ABBREVIATIONS AND ACRONYMS

- A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.
- B. SPD: Surge Protective Device.

1.05 REFERENCE STANDARDS

- A. IEEE C62.41.1 - IEEE Standard Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits.
- B. ISO 9001 - Quality Management Systems — Requirements.
- C. MIL-STD-220 - Method of Insertion Loss Measurement.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.
- G. NFPA 70 - National Electrical Code.
- H. UL 1283 - Standard for Electromagnetic Interference Filters.
- I. UL 1449 - Standard for Surge Protective Devices.
- J. ANSI - American National Standards Institute
 - 1. ANSI C84.1 - American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hz).
- K. IEEE - Institute of Electrical and Electronics Engineers
 - 1. IEEE C62.41.1 - Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits.
 - 2. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
 - 3. IEEE C62.45 - Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
 - 4. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems (Green Book).
 - 5. IEEE 1100 - Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (Emerald Book).
- L. ISO - International Organization for Standardization
 - 1. ISO 9001 - Quality Management System

1.06 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.

1.07 SUBMITTALS

- A. See Section 26 05 00 - Common Work Results for Electrical, for submittal procedures.
- B. Include written specification response referencing each specification section and sub-section indicating compliance or non-compliance. If manufacturer cannot fully comply with specification section, this must be stated in the response along with a full description of the variance.
- C. 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.
 - 1. SPDs with EMI/RFI filter: Include noise attenuation performance.
- D. Shop Drawings: Include wiring diagrams showing factory and field connections with wire and circuit breaker/fuse sizes.
- E. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
 - 1. UL 1449.
 - 2. UL 1283 (for Type 2 SPDs).

- F. Published specifications, cut sheets and product data with appropriate IEEE C62.41 and UL 1449 (current edition) performance ratings for intended installation locations.
- G. Field Quality Control Test Reports.
- H. 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.
- I. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- J. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- K. Project Record Documents: Record actual connections and locations of surge protective devices.

1.08 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. Qualifications:
 - 1. UL 1449 (current edition) compliance and listing from Nationally Recognized Test Lab (NRTL) accepted by local authority having jurisdiction. Type 1 compliance required for SPD intended for installation before (or after) Main Service Disconnect or Type 2 compliance for installation after Main Service Disconnect. Provide published UL 1449 (current edition) Nominal Discharge Current Rating and Voltage Protection Rating.
 - 2. Local representation and distribution within 400 miles of the project location to provide technical, warranty claim, and installation support for the project.
 - 3. Manufacturer/vendor must be capable of supplying SPD for project within 30 days of receipt of order for orders of 25 units and less for models submitted in response to this specification.
 - 4. Certified to latest ISO 9001 standard and registered for the design and manufacturing of SPD devices.
 - 5. Provide access to a readily available factory engineer for answering questions about this product.
 - 6. Only firms regularly engaged in the manufacture of SPD products for category C locations (ANSI/IEEE C62.41.1-2002), and whose products have been providing satisfactory service for not less than five years, considered. Upon request, provide a customer reference list, with a minimum of five contact names and current phone numbers.
 - 7. Provide manufacturer qualifications as part of the submittal.
 - 8. The successful manufacturer/vendor to assign a technical contact person for SPD application, installation, and warranty questions. Contact available to provide a response to a technical question within a maximum of two business days.
 - 9. Single manufacturer capable of providing power system SPD's.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.09 DELIVERY, STORAGE, AND PROTECTION

- A. Inspect for damage and replace any damaged device.

- B. Store in a clean, dry space suitable for equipment and protect against damage. Store in accordance with manufacturer's written instructions.
- C. Clean equipment and touch up minor scratches using suitable materials.

1.10 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.11 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Period: 20 years from the date of substantial completion of service and activation of the system to which the SPD is attached.
- C. Full replacement of a suppressor which is damaged or fails to meet manufacturers published specifications and specifications provided within, without pro-rating value.
- D. No exclusions from failure or damage from any system anomaly (over-voltage, single phasing, lightning strike, etc. (IEEE C62.41.1).
- E. Exceptions: Failure caused by wiring error, loose, or missing Neutral to Ground Bond or Megger Testing with SPD connected to power system.
- F. Factory or third party testing not required.
- G. Warranty applies independent of facility ownership / purchaser.
- H. Replacement unit to be at facility within 7 business days of receipt of written notification of failure at no cost to the customer (exception – custom configuration or special order units).
- I. Replacements: same make, model and configuration as original unit unless otherwise requested or approved.
- J. Manufacturer site visit for validation of warranty claim: manufacturer/vendor must visit site within 3 days of notification at no cost.
- K. No shipping, handling, examination or other fees are allowed.
- L. 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 .
 - 2. Advanced Protection Technologies, Inc (APT).
 - 3. Current Technology; a brand of Thomas & Betts Power Solutions .
 - 4. nVent ERICO: www.nvent.com/#sle.
 - 5. Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.
 - 6. Schneider Electric; Square D Brand Surgelogic Products .
- B. Factory-installed, Internally Mounted Surge Protective Devices:
 - 1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.
- C. Substitutions: See Section 01 60 00 - Product Requirements.

- D. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.
- E. This listing of specific manufacturers above does not imply acceptance of their products which do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

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. Utilize Metal-Oxide Varistors (MOV) components as primary energy mitigation. Selenium cell, air gaps, gas tubes are not allowed.
- E. Performance and Ratings:
 - 1. Minimum durability and performance requirements are described below in accordance with test procedures outlined in ANSI/IEEE C62.45 and UL 1449 (current edition). Provide test documentation as part of the submittal package. Provide information in a format which is easily to analyze and review. Submit the following test data as manufacturer published literature:
 - a. Provide Peak Surge Current (Single Pulse Rated, 8/20 μ S, by mode, Amperes) with submittals document for each SPD proposed. For electrical equipment located at Service Entrance or Category C locations, Surge current rating a minimum of 160kA per phase / 80kA per mode for IEEE C62.41.1-2002 - Category C Low Exposure locations and 300kA per phase / 150kA per mode for IEEE C62.41.1-2002-Category C High Exposure locations or critical locations.
 - b. Provide surge current ratings for each applicable protection mode (L-L, L-N, L-G and N-G) with submittals.
 - c. Surge Current Rating: Minimum of 80kA per phase / 40kA per mode in low exposure locations or 120kA per phase / 60kA per mode for distribution switchboards or motor control centers in medium and high exposure / critical equipment locations and for IEEE C62.41.1-2002 - Category B and C Switchboard and Motor Control Center Locations.
 - d. Provide surge current ratings for each applicable protection mode (L-L, L-N, L-G and N-G) with submittals.
 - e. Surge Current Rating:
 - 1) Minimum of 80kA per phase / 40kA per mode for branch panel models in low, medium and high exposure areas and for IEEE C62.41.1-2002 - Category B and C Panel and Sub-Panel Locations.
 - f. Provide surge current ratings for each applicable protection mode (L-L, L-N, L-G and N-G) with submittals.

- g. For each SPD proposed, provide published durability test data utilizing the ANSI/IEEE C62.41-1991, Category C3, 20kV/10kA, 1.2 x 50 μ S - 8x20 μ S combination waveform for SPD durability tests with (as a minimum), the ANSI/IEEE C62.41-1991, Category C1, 6kV/3kA, 1.2 x 50 μ S - 8x20 μ S combination waveform used for pre and posttest measurement of let through performance variation. Provide test data with submittals, including test setup information.
 - h. SPD devices withstand a minimum of 15,000 IEEE C3 20kV/10kA hits delivered at a rate not exceeding one pulse per minute without failure or degradation exceeding 5 percent using IEEE B3 6kV/3kA combination waveform for pre and post durability let through measurement evaluation. Lead length for testing and let through measurements, 6-inches.
 - i. UL Third Edition Nominal Discharge Current Ratings a minimum of 20kA per mode for SPD's to be installed at the Service Entrance (or where direct lightning strike potential exists on outdoor feeder or branch circuit conductors serving electrical equipment) and a minimum of 10kA per mode for all other locations.
 - j. Provide EMI/RFI Attenuation as per Mil Std-220. Attenuation 40dB at 100 kHz.
- F. Protected Modes:
- 1. Wye Systems: L-N, L-G, N-G, L-L.
 - 2. Delta & High Resistance Grounded Systems: L-G, L-L.
 - 3. Single Split Phase Systems: L-N, L-G, N-G, L-L.
 - 4. High Leg Delta Systems: L-N, L-G, N-G, L-L.
- G. UL 1449 Voltage Protection Ratings (VPRs):
- 1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
- H. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage or 125% for 120/208 volt systems.
- I. 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 3R.
- J. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
- 1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
 - 2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.
- K. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
- 1. Switchgear: See Section 26 23 00.
 - 2. Switchboards: See Section 26 24 13.
 - 3. Panelboards: See Section 26 24 16.
 - 4. Motor Control Centers: See Section 26 24 19.
 - 5. Busway Plug-in Units: See Section 26 25 13.
- L. Surge Protective Device:
- 1. Protection Circuits: Field-replaceable modular or non-modular.
 - 2. Surge Current Rating: Not less than 80 kA per mode/160 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 status for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

2.03 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

- A. As a minimum, Branch Panel, Sub-Panel, and series installed (branch circuit) SPD includes a passive circuit which allows the SPD to actively follow the voltage waveform and provide a clamping envelope to limit low level IEEE C62.41 Category A ring waves (of either polarity) at all locations on the sine wave. Circuit to perform in the Neutral to Ground Mode.

2.04 DIAGNOSTICS:

- A. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
- B. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
- C. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

2.05 ENCLOSURE

- A. NEMA rated metal enclosure appropriate for environmental conditions and exposure at point of installation.
- B. Designed to allow connection of the SPD without sharp bends in the conductors.
- C. Metal flush kits for flush mount installations (external devices) on new and retrofit applications for panels. Include supports for fastening to structural members and include a faceplate matching SPD finish. Retrofit kits capable of being installed next to the panel after drywall has been installed without the need for patching or refinishing of the wall.

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 05 26, 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. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- F. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- G. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.
- H. Service Entrance Installation Requirements
 - 1. One primary suppressor at each utility service entrance to the facility or as indicated on the drawings.
 - 2. Unless otherwise indicated, connect surge protective device to properly rated disconnect (including overcurrent and short circuit protective device) on the load side of the service entrance disconnecting means in accordance with NEC requirements.
 - 3. Conductors between suppressor and point of attachment kept as short and straight as possible and group together (via tie wrap) where possible. Lead length of connecting conductor not to exceed 2 feet without written permission of the Engineer.
 - 4. Bond suppressor's ground to enclosure frame and the service entrance ground bus, and conduit between the SPD and the switchboard must provide secure electrical/mechanical connections.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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.
- D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Lenses
 - 2. Reflector Cones
 - 3. Housings
 - 4. Finish
 - 5. Suspension
 - 6. Lamps and Sockets
 - 7. Power Supplies
 - 8. Transformers
 - 9. Exterior Luminaires
 - 10. Extra Material
 - 11. Disposal and Replacement

1.02 DEFINITIONS

- A. BACNET - Protocol for integration with BAS/BMS/EMS
- B. BAS - Building Automation System,
- C. BMS - Building Management System
- D. EMS - Energy Management System
- E. CCT- Correlated Color Temperature
- F. CRI - Color Rendering Index
- G. CS - Control Station
- H. D - Dimming Wall Switch
- I. DT - Dual Technology (PIR + U)
- J. FC - Footcandles
 - 1. The metric for measuring illuminance light levels
 - 2. GUI - Graphic User Interface
 - 3. LCP - Lighting Control Panel
 - 4. LED - Light Emitting Diode
 - 5. LonWorks - Protocol for integration with BAS/BMS/EMS
 - 6. MTBF - Minimum Time Between Failures
 - a. Total hours of testing / Number of failures
 - 7. OS/VS - Occupancy Sensor / Vacancy Sensor,
 - a. Occupancy sensors provide automatic on and automatic shut-off.
 - b. Vacancy sensors provide automatic shut-off only, and require manual-on.
 - 8. PC - Photocell
 - 9. PIR - Passive Infrared Technology
 - 10. Power Supply Ballasts and LED drivers
 - 11. RS - RS-232 Connection for AV Integration
 - 12. SC - Scene Control
 - 13. TC - Timeclock, or astronomical timeclock
 - 14. U - Ultrasonic Technology

15. WS - Wall Switch
16. WS/O - Wallbox Occupancy Sensor Switch
 - a. Wall Switch with integrated Occupancy Sensor

1.03 REFERENCE STANDARDS

- A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts.
- B. ANSI E1.11 - Entertainment Technology - USITT DMX512-A - Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories.
- C. ANSI E1.20 - Entertainment Technology - RDM - Remote Device Management over DMX512 Networks.
- D. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- E. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code).
- F. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements.
- G. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products.
- H. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources.
- I. NFPA 70 - National Electrical Code.
- J. TIA-485 - Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems.

1.04 QUALITY ASSURANCE

- A. The lighting design for this project was based on luminaire types and manufacturers as specified.
- B. Basis of Design manufacturers are pre-qualified to bid on products where specified. Inclusion of manufacturer and product series does not relieve specified manufacturer from providing product as described in luminaire schedule; modifications to standard product, if required, include with initial bid.
- C. Alternate manufacturers listed in the Luminaire Schedule do not require prior approval but included with the shop drawing submittal. Inclusion of manufacturer and product series as an alternate does not relieve the manufacturer from providing product equivalent to the basis of design as described in luminaire schedule; modifications to standard product, if required, include with initial bid.
- D. Or Approved or Pre-Bid Approved Equal:
 1. Submit Substitution Request prior to bid, complying with requirements of Division 01, General Requirements.
 2. Approval determined by review of the following luminaire characteristics where applicable. Lack of pertinent data on characteristic constitutes justification for rejection of the submittal.
 - a. Performance:
 - 1) Distribution
 - 2) Utilization
 - 3) Average brightness/maximum brightness.
 - 4) Spacing to mounting height ratio.
 - 5) Visual comfort probability.

- b. Construction:
 - 1) Engineering
 - 2) Workmanship
 - 3) Rigidity
 - 4) Permanence of materials and finishes.
- c. Installation Ease:
 - 1) Captive parts and captive hardware.
 - 2) Provision for leveling.
 - 3) Through-wiring ease.
- d. Maintenance:
 - 1) Relamping ease.
 - 2) Ease of replacement of ballast and lamp sockets.
- e. Appearance:
 - 1) Architectural integration.
 - 2) Light tightness.
 - 3) Neat, trim styling.
 - 4) Conformance with design intent.

1.05 GENERAL REQUIREMENTS

- A. Provide lighting outlets indicated on the Drawings with a luminaire of the type designated and appropriate for the location.
- B. Where a luminaire type designation has been omitted and cannot be determined by the Contractor, request a clarification from the Architect in writing and provide a suitable luminaire type as directed.
- C. Coordinate installation of luminaires with the ceiling installation and other trades to provide a total system that is neat and orderly in appearance.
- D. Luminaires located in fire rated assemblies rated for use in such assemblies or have assembly maintained by the installer through the use of appropriate construction techniques to maintain the assembly rating. It is the responsibility of the Contractor to maintain the assembly rating and provide required components during construction. Coordinate luminaires impacted with Division 01, General Requirements, and life safety documents.
- E. Install remote power supplies and transformers in enclosures as required by luminaire specified. Locate remote power supplies and transformers as shown on drawings; where no location is shown, provide recommendation for approval prior to commencing field installation. Locate remote mounted power supplies and transformers within the distance limitations specified by the manufacturer.
- F. Exterior pole lights have an appropriated pole base as part of the assembly. For pole lights in pedestrian areas, use a flush pole base. Pole lights in parking areas a raised base used. Pole bases, footings, and structural components reviewed and approved by a state licensed structural engineer prior to ordering and installation.
- G. Linear lighting elements installed on building exterior, in coves, soffits, panels and other architectural materials are the longest sections available to meet the intent of the design and centered in the available space. Other items required to make the lights function installed out of site and coordinated with Architect, Landscape Architect, Lighting Designer, and Electrical Engineer of Record. Transformers, drivers, and ballasts in suitable enclosures. Required connection points are the minimum box or connector available from the manufacturer. Standard electrical boxes are not allowed to produce linear runs in architectural coves. Ancillary material required is concealed from view. Coordinate final ceiling material, dimensions, and limitations with the ceiling manufacturer prior to ordering and installation.

- H. Coordinate voltage requirements to each luminaire as indicated on drawings.
- I. Verify luminaires carry a valid UL or ETL listing. Luminaires located in outdoor locations to carry and appropriate wet or damp listing as required for the mounting application.
- J. Procure luminaires through a distributor located within 200 miles of the project site with a valid business license in the state the project is located.
- K. Upon request of the Architect, Engineer, or Owner, provide back-up pricing in a unit cost breakdown per luminaire. Back-up pricing includes distributor net pricing, Contractor net pricing, final Owner pricing and mark-ups and discounts (lot price or all-or-none) associated with the luminaires.
- L. Lighting related change orders to include back-up pricing noted above for review by the Engineer and Lighting Designer.
- M. Provide manufacturer's warranty covering 5 years on drivers from date of purchase. Luminaire manufacture to operate driver at or below the required driver warranty temperature. Luminaire manufacturers failing to operate the driver, at the project required ambient temperature and within the driver manufacturer warranty parameters will be responsible for driver warranty related costs over the warranty period.
- N. 80 percent of the luminaire material by weight at a minimum should be recyclable at end of life. Design luminaire for ease of component replacement and end-of-life disassembly.

1.06 SUBMITTALS

- A. Submit the following in accordance with Section 26 05 00 - Common Work Results for Electrical:
 - 1. Shop Drawings, to include:
 - a. Product Data.
 - 1) Provide manufacturer's published product data information.
 - 2) This information is to be relevant to the specified product only.
 - 3) Submittals limited to not more than three sheets for each type specified.
 - 4) They are specifically not to have configurations available included for review.
 - 5) Submittals that contain information that is not relevant to the product specified will be rejected in total and resubmission will be required.
 - b. Luminaire dimensions on a fully dimensioned line drawing.
 - c. Lamp information, including array configuration:
 - 1) For LED lamps: proof of conformance with the following: ANSI C78.377-2015, IES LM-79-2008, IES LM-80-2008, IES LM 82-2012, IES LM 84-14, IES LM 85-14, IES TM 21-2011, IES TM 28-14 and special certifications required by the contract documents.
 - d. Lamp socket information.
 - e. Power supply and transformer information using ballast manufacturers published product data information. Multiple power supplies or transformers may be submitted for single luminaire if compatible with specification included in contract documents. Include certification of lamp and power supply and transformer compatibility for submitted.
 - f. Mounting details including clips, canopies, supports, and methods for attachment to structure. Provide equipment required for row configurations.
 - g. UL/ETL Labeling Information
 - h. Manufacturer's Warranty
 - i. Photometric Reports consisting of the following:

- 1) Candlepower distribution curves: Provide five plane candlepower distribution data at no more than 5 degree vertical angle increments.
 - 2) Coefficient of utilization table.
 - 3) Zonal lumen summary including overall luminaire efficiency.
 - 4) Luminaire luminance: Provide measured maximum brightness data for luminaires with reflectors and average brightness data for luminaires with refractors.
 - 5) Spacing to mounting height ratio. If parallel and perpendicular ratios differ, provide data on each plane.
 - 6) Pole information to include maximum supported effective projected area (EPA) and weight for the design wind speed, as well as structural calculations for each pole proposed.
 - 7) VCP calculations (where applicable): For general office lighting luminaires, provide typical VCP calculations for ceiling heights between 9-foot and 12-feet at 1-foot increments, for room sizes 20-feet by 20-feet and 30-feet by 30-feet.
- j. Special requirements of the specification.
2. Operation and Maintenance Data:
 - a. Prepare two copies of a Lighting Systems Maintenance Manual consisting of the following in a hard-cover binder for review. After review, Architect will deliver one copy to Owner. Manual to include:
 - 1) One complete set of final submittals of actual product installed, including product data and shop drawings. Include product data for actual power supply and transformer installed where applicable.
 - 2) List of lamps used in Project, cross-referenced to fixture types, with specific manufacturer's names and ordering codes.
 - 3) Re-lamping instructions for lamps that require special precautions (LED, tungsten halogen, metal halide, etc.).
 - 4) Lighting fixture cleaning instruction, including chemicals to be used or avoided.
 - 5) Parts list of major luminaire components and ordering information for replacement
 - 6) Copies of manufacturer warranties on product.
 3. 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.
 4. Manufacturer's Installation Instructions:
 - a. Indicate application conditions and limitations of use stipulated by product testing agency.
 - b. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
 5. Closeout Submittals:
 - a. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.
 - b. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
 - c. Maintenance Materials: Furnish for Owner's use in maintenance of project.

PART 2 PRODUCTS

2.01 GENERAL

- A. Luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.
- B. Luminaire assemblies UL listed.
- C. Luminaires UL listed appropriate to mounting conditions and application.
- D. Each luminaire family type (downlights, troffers, etc.) supplied by only one manufacturer.
- E. Install recessed luminaires in fire rated ceilings and use a fire rated protective cover thermally protected for this application and carry a fire rated listing.
- F. Luminaires installed under canopies, roofs, or open areas and similar damp or wet locations to be UL listed and labeled as suitable for damp or wet locations.

2.02 LENSES

- A. Mechanically secured from within the housing.
- B. Interior linear prisms with smooth exterior.
- C. Prismatic Acrylic:
 - 1. 12-inch by 24-inches and Larger: Extruded of clear virgin acrylic plastic, 0.125-inch minimum overall thickness, 0.1-inch nominal unpenetrated thickness, Pattern 12 with flat sided female prisms running at 45 degrees off panel axis unless otherwise specified in the luminaire schedule. Concave prisms are not acceptable.
 - 2. 12-inch by 24-inches and Larger: Low brightness type, extruded of clear virgin acrylic plastic, 0.156-inch minimum overall thickness, 0.1-inch nominal unpenetrated thickness, Pattern 19 with flat sided male prisms running parallel with panel axis unless otherwise specified in the luminaire schedule. Concave prisms are not acceptable.
 - 3. 12-inch by 24-inch and Larger: Injection molded of clear virgin acrylic plastic, 0.16-inch minimum overall thickness with 0.125-inch nominal unpenetrated thickness square cone base, similar to Pattern 12 configuration.
 - 4. As specified in the Luminaire Schedule.
- D. Opal Acrylic:
 - 1. Extruded or injection molded of virgin acrylic plastic, 0.08-inch minimum overall thickness.
 - 2. As specified in the Luminaire Schedule.
- E. Opal Acrylic Overlay: High transmittance type, extruded of virgin acrylic plastic, 0.04-inch overall thickness, with minimum 80 percent light transmittance.

2.03 REFLECTOR CONES

- A. Spun of uniform gauge aluminum, free of spinning marks or other defects.
- B. Integral trim flange.
- C. Color and finish as specified in Luminaire Schedule.
- D. White Reflectors:
 - 1. Steel or aluminum, minimum 22 gauge, with hard baked white enamel finish with minimum 85 percent reflectance.
- E. Alzak Reflectors:
 - 1. Low iridescent specular or as indicated in the luminaire schedule, Alzak or Coilzak with minimum reflectance of 90 percent.

2. Supply luminaires using Alzak reflector cones by the same manufacturer unless directed otherwise in Luminaire Schedule.

2.04 HOUSINGS

- A. Dimensions:
 1. Proper for the various wattage noted on the plans and as recommended by the luminaire manufacturer or as specified in the luminaire schedule.
- B. Extruded Aluminum Housing:
 1. One piece housing of AA 6063 T5 extruded aluminum with 0.14 minimum thickness smooth and free of tooling lines in one uninterrupted section of 1-foot to 24-foot with the cross sectional dimensions as indicated in the Luminaire Schedule.
 2. Section lengths as shown on the drawings and able to be transported into and out of the installation location after final construction without building demolition being required.
- C. Steel Housing:
 1. 20 gauge minimum, free of dents, scratches, or other defects.
 2. Fill and sand exposed weld marks, joints, and seams smooth before finishing. Clean and dress edges to remove sharp edges or burrs.
 3. Section lengths as shown on the drawings comprised of 1-foot to 12-foot lengths.
- D. Sheet Metal Housings:
 1. Minimum 22 gauge cold-rolled steel, with welded joints. Exposed weld marks and seams filled and ground smooth.
- E. Door Frames for lensed luminaires:
 1. White painted, flat aluminum with mitered corners, rotary cam latches to hinge from either side.
- F. End Plates:
 1. Mechanical attach die cast end plates without exposed fasteners. End caps, minimum 0.125-inch thick.
- G. Provide an internal alignment spline where housing sections are joined together to form a continuous row.
- H. Recessed Luminaires
 1. Rated for use in recessed applications.
 2. If required by the Owner or design team, the manufacturer must produce test data proving the product is rated for use in recessed applications.
 3. Equip with through wire junction box. Box, power supply, and replaceable components accessible from the ceiling opening of the luminaire.
- I. Luminaires used as air-handling registers for HVAC systems meet the requirements of NFPA 90A.
- J. For wet and damp use, LED-based luminaire to be sealed, rated, and tested for appropriate environmental conditions and may not be accomplished by using an additional housing or enclosure

2.05 FINISH

- A. Visible surfaces to be of color and texture as directed in Luminaire Schedule.
 1. Baked white dry polyester powder, if not specified, with a minimum average reflectance of 85 percent on exposed and light reflecting surfaces.
- B. Concealed interior and exterior luminaire surfaces to be Matte black or as recommended by the luminaire manufacturer.

- C. Prepare steel components for finishing with a 5-step zinc phosphating process prior to painting.
- D. Paint luminaire (including painted component parts) after fabrication unless specifically noted in the Luminaire Schedule.
- E. Exposed aluminum surfaces:
 - 1. Satin etched and clear anodized.
 - 2. Treat with an acid wash and clear water rinse prior to painting.
 - 3. Electrostatically paint or powder coat and oven bake in the color indicated in the Luminaire Schedule.
- F. Exposed steel surfaces:
 - 1. Treat with acid wash and clear water rinse, then prime coat.
 - 2. Electrostatically paint or powder coat and oven bake in the color indicated in the Luminaire Schedule.

2.06 SUSPENSION

- A. Suspension Devices, type as specified in the Luminaire Schedule:
 - 1. Aircraft Cable:
 - a. Stainless steel type - 3/32-inch nominal diameter, stranded, with positive pressure, field adjustable clamp at fixture connection.
 - 2. Rigid Pendant:
 - a. 1/2-inch nominal diameter or as specifically shown on drawings.
 - b. Supplied by fixture manufacturer when available as standard product.
 - c. At fixture end of stems, provide earthquake type swivel fitting to permit 45 degree swing in any direction away from vertical.
 - d. Flat canopy to permit splice inspection after installation.
 - 3. Chain Hangers:
 - a. Length to suit fixture mounting height if shown or as field conditions dictate.
 - b. Use two heavy duty chains with S hooks at each suspension point.
 - c. Length to suit mounting height as shown on Drawings.
 - 4. Suspension system must permit $\pm 1/2$ -inch minimum vertical adjustment after installation.
- B. Supports:
 - 1. Provide internal safety cable from fixture body to structure.
 - 2. Carry fixture weight to structure and provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting. Provide diagonal seismic restraint wires per code.
- C. Feed Point:
 - 1. Flat-plate canopy to cover outlet box, with holes for support cable and power cord, concealed fasteners to permit splice inspection after installation.
 - 2. At the electrified connection provide straight cord feed. Provide a separate feed point where emergency feed is required.
 - 3. Power Cord:
 - a. White multi-conductor cord, parallel to support cable (aircraft cable); within pendant (rigid pendant); or flexible conduit (chain hanger).
 - 4. Provide a separate fee point where emergency feed is required.
- D. Non-feed Points:
 - 1. 1/2-inch OD polished chrome end sleeve, inside threaded 1/4-inch-20, with 2 -inch diameter. Flat white plate to cover hole in ceiling. Top of cable with ball swaged on end, to fit inside sleeve.
 - 2. Provide support above ceiling as required.

- E. Suspension method allows adjustment to be made in hanging length to allow for variance in ceiling height.
- F. Exposed paintable suspension components have the same finish and color as the luminaire housing.

2.07 LAMPS AND SOCKETS

- A. Lamp each luminaire with the suitable lamp cataloged for the specific luminaire type and as indicated by the manufacturer, or as specifically indicated in the Luminaire Schedule, or as specified herein.
- B. Lamps to be field replaceable.
- C. Lamp sockets to be of configuration and design to accept standard LED lamps and circuit boards.
- D. LED lamps to meet or exceed 50,000 hours as defined by LM-80-08 based on both the ambient temperature listed and the LEDs B10L70 performance curve as published by the LED lamp manufacturer.
- E. LED lamps to be high brightness and proven quality from established and reputable LED manufacturers, including:
 - 1. Nichia
 - 2. Osram-SemiOpto
 - 3. Cree
 - 4. Philips Lumileds
 - 5. Seoul Semiconductor
 - 6. Bridgelux
 - 7. General Electric Gelcore
 - 8. Xicato
 - 9. Osram
- F. Replacement Lamps
 - 1. Sorra
 - 2. Toshiba
- G. LED lamps that are integral into the housing; light bars, diodes, boards and other, to be rated and tested for use in the fixture specified and compatible with the driver tested and compatible with that fixture.
- H. Screw-In Base Replacement LED Lamps
 - 1. Manufacturer to provide wattage restriction label on socket, equivalent to specified wattage on LED replacement lamp.
 - 2. LED replacement lamps not to be placed in air-tight enclosures or in insulated air tight (ICAT) rated luminaire enclosures without dedicated heat dissipation and thermal management of the luminaire system.
- I. Color Rendering Index (CRI):
 - 1. 80 or higher for ambient lighting in common spaces
 - 2. 90 or higher for accent lighting in common spaces
 - 3. 95 or higher for art lighting
 - 4. As indicated in the luminaire schedule
- J. Color Rendering Index (CRI): 90+ per ANSI C78.377-2008/CIE 13.3-1995 unless noted otherwise on the luminaire schedule.
- K. Correlated Color Temperature (CCT) per luminaire schedule.
 - 1. Color consistency not to exceed a +/- tolerance of greater than two MacAdam Ellipses over the life of the luminaire.

- L. Adjustable Lamp Mechanisms: To have aiming stops which can be permanently set to position lamp vertically and rotationally.
- M. High power LED luminaire thermally protected using one or more of the following thermal management techniques: metal core board, gap pad, and/or internal monitoring firmware
- N. Operating Temperature: -22 degrees F to 115 degrees F.
 - 1. Operate below manufacturer's published die junction temperatures when operated at 1W at 350 mA in an elevated ambient of 46 degrees C.
- O. Utilize quick-connect connections to replaceable boards to meet ANSI and UL/ETL and NEMA requirements.

2.08 POWER SUPPLIES

- A. UL recognized under the component program and modular for simple field replacement.
- B. Rate for use with the LED array specified.
 - 1. Warranty array and driver as an assembly.
 - 2. 5 year full replacement, non-pro-rated warranty is required on electronic components.
- C. Luminaires requiring more than one driver are not permitted, unless specified in the luminaire schedule.
- D. Power supplies used in enclosed and gasketed luminaires listed for use in wet locations, Type 1 construction.
- E. Rate for the expected ambient temperature in which they are installed.
 - 1. Exterior installed power supplies rated to start the lamps at 0 degrees F.
- F. Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.
- G. Power Factor: 0.9 minimum
- H. Lifetime minimum
 - 1. 50,000 hours at full load and 77 degrees F ambient
 - 2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
- I. Minimum time between failures (MTBF) greater than 300,000 hours at full load and 77 degrees F ambient, in accordance with MIL-HDBK-217.
- J. Driver and luminaire electronics deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10).
 - 1. Flicker index to be less than 5 percent at frequencies below 1000 Hz.
- K. Label systems using tandem wired luminaires be labeled accordingly. Locate label in the lamp compartment of each luminaire and identify the function of that luminaire. Do not make the label visible from room.
- L. Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. At no point in the dimming curve allow imbalance current to exceed full output THD.
- M. Meet or exceed 30mA2s at 277VAC for up to 50Ws of load and 75A at 240us at 277VAC for 100 watts of load.
- N. Withstand up to a 1,000V surge without impairment of performance as defined by ANSI C62.41 Category A.
- O. Housing have circuit diagrams and lamp connections applied thereto.
- P. Must be Reduction of Hazardous Substances (RoHS) compliant

- Q. Provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control deadband between 0.5V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.
- R. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
1. Adjustment of forward LED voltage, supporting 3V through 55V.
 2. Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA
 3. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
- S. Remote: Driver may be remote mounted up to 300-feet depending on power level and wire gauge.
- T. Dimming Drivers:
1. Dimming power supplies controlled by a common controller provided by the same manufacturer.
 2. Manufacturer to have minimum 5 years' experience in manufacturing of dimmable electronic lighting drivers.
 3. LED dimming to be equal in range and quality to a commercial grade incandescent dimmer. 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 a commercial environment.
 - a. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
 4. Provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 - 1 percent light output and step to 0 percent where indicated. Driver responds similarly when raising from 0 percent to 100 percent.
 - a. Driver to be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
 5. Track evenly across multiple fixtures at light levels, and provide input signal to output light level that allow smooth adjustment over the entire dimming range.
 6. Limit inrush current.
 7. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
 8. Ability to configure a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels
 9. Basis of Design Product: eldoLED or subject to compliance and prior approval with specified requirements of this section, one of the following:
 - a. eldoLED
 - b. Philips
 - c. Osram Sylvania
 - d. Tridonic
 - e. General Electric
 10. Dimming Protocols:
 - a. If not otherwise noted on the luminaire schedule, dimming LED drivers to be 0-10V.
 - b. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
 - 1) Must meet IEC 60929 Annex E for General White Lighting LED drivers

- 2) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
- 3) Must meet ESTA E1.3 for RGBW LED drivers
- 4) 0-10V input protected from line voltage miswire, and immune and output unresponsive to induced AC voltage on the control leads.
- c. Digital (DALI Low Voltage Controlled) Dimming Drivers
 - 1) Must meet IEC 62386
- d. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers
 - 1) Must meet DMX / RDM: ANSI/TIA-485, ANSI E1.11 - USITT DMX512A and ANSI E1.20 (Explore and Address)
 - 2) Capable of signal interpolation and smoothing of color and intensity transitions.
 - 3) Luminaires requiring more than one driver are not permitted.
 - 4) Drivers may be connected to the DMX bus by a T-tap spur not to exceed 12-inch in absolute length. In other cases, a DMX input and output connection must be provided.
- e. As indicated in the luminaire schedule.

2.09 TRANSFORMERS

- A. Provide proper lamp voltage to low voltage lamps.
 1. Integral:
 - a. Magnetic: Encapsulated for silent operation, securely mounted to the luminaire and removable through the aperture for hard ceiling installations or remote where shown on drawings.
 - b. Electronic: Do not provide electronic transformers unless directed in the Luminaire Schedule.
 2. Remote:
 - a. Magnetic:
 - 1) Encapsulated for silent operation, securely mounted accessible in location shown on drawings.
 - 2) Provide code-sized primary and secondary circuit protection via fuses, quantity of secondary circuits as required to serve specified load.
 - b. Electronic:
 - 1) Do not provide electronic transformers unless directed in the Luminaire Schedule.

2.10 EXTERIOR LUMINAIRES

- A. Label fixtures from the factory for use in the designed installation. It is the responsibility of the Contractor to verify labeling and installation requirements with the NEC and applicable codes and standards.
 1. External Label: ANSI C136.15
 2. Luminaires must have locality-appropriate governing mark and certification.
- B. The luminaire must be subjected to 100,000 cycles of 2 Gs at the resonant frequency of the luminaire (between 5 and 30 Hz) applied at the center of gravity of the luminaire on three primary axes per ANSI C136.31 without damage to the luminaire. Fully functional luminaire upon completing the test.

- C. Luminaire must be IP and/or UL-listed for damp or wet locations, as appropriate for exterior application, and wiring cavity must be field accessible for service or repair needs.
- D. Provide luminaires fully assembled and electrically tested before shipment from factory.
- E. Optical cavity must be a minimum IEC 60529/IP65.
- F. Rate luminaires for -4 degrees F to 104 degrees F operation.
- G. The coating must be capable of surviving ASTM B117 Salt Fog environment for 500 hour minimum without blistering or peeling. The coating must demonstrate gloss retention of greater than or equal to 90 percent for 500 hour exposure QUV test per ASTM G53 UVB313, 4 hour UV-B 140 degrees F/4 hour condensation 122 degrees F.
- H. Provide luminaires with a NEMA distribution pattern as indicated in the luminaire schedule.
- I. Water feature and fountain lighting to meet applicable codes and regulations.
- J. Project Conditions Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under Work of Other Sections, or by others.
 - 2. Coordinate elevation to obtain specified foundation height.
 - 3. Notify Owner of conflicts or deviations; obtain direction prior to proceeding with Work.
- K. Exterior Lenses
 - 1. In-grade lenses drive-over and cool touch rated
 - 2. For lenses not integral to the LED lamp, construct the luminaire optical enclosure (lens/window) of clear and UV-resistant polycarbonate, acrylic, or glass.
- L. Unless otherwise indicated, provide cast-in-place embedded style concrete foundations with constructed forms for square foundations or round foundations with spirally wrapped treated paper forms. Provide concrete, anchor bolts, and reinforcing steel as indicated in the Drawings.
- M. Poles:
 - 1. Provide poles of material and form as indicated in the luminaire schedule. Provide poles able to withstand winds of not less than 100 mph and a gust factor of 1.3 with an ice load criteria up to 1/2-inch thick without damage to the pole and attached luminaire.
 - 2. Provide poles with a hand-hole and removable hand-hole coverplate that matches the material and finish of the pole. Install covers with vandal resistant bolts. Locate hand-hole located approximately 18-inches above the pole base.
 - 3. Provide poles with provisions for installation of Owner provided and installed security cameras. Provide hand-hole with removable hand-hole coverplate that matches the material and finish of the pole. Locate hand-hole based on Owner design of security cameras.
 - 4. Provide poles with an internal ground lug easily accessible from the hand-hole.
 - 5. Provide poles with a base plate welded to the pole utilizing a backup ring and full-penetration welded connection.
 - 6. Provide a one piece base cover to completely cover foundation hardware.
 - 7. Aluminum Poles:
 - a. Seamless extruded aluminum shafts fully welded to a cast aluminum anchor base assembly.
 - 1) Provide shaft square, straight, and meeting requirements of AASHTO Standard Specifications.
 - 2) Pole Height: As indicated in the Luminaire Schedule.
 - 8. Pole Finish:

- a. Provide external surfaces of the pole, base cover, support arms, and luminaires finished in the same material and color.
 - b. Provide poles chemically cleaned, rinsed, phosphatized, sealed, and dried.
 - c. Apply an electrostatic application of polyester-power paint to external surfaces.
 - d. Oven-bake complete unit to form a homogeneous, non-porous surface. Provide completed finish with no sags, drips, oxidation, or runs.
9. Anchor Bolts: Provided by pole manufacturer of size and length and quantity as recommended by pole manufacturer.
- a. Fabricate anchor bolts from hot rolled carbon steel bar with an L bend on one end.
 - b. Provide galvanized anchor bolts with a minimum of 12-inches on the threaded end.
 - c. Provide bolt circle and bolt projection dimensions with manufacturer's Shop Drawings.
10. Wrap poles in a protective material for shipment to the Project site.

2.11 EXTRA MATERIAL

- A. Furnish extra materials described below that match product installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Glass and plastic lenses, covers, louvers, globes, guards, and other removable fixture parts: 5 percent or one dozen (whichever is less) of each type and rating installed. Furnish at least one of each type.
 2. Control gear: 5 percent or one dozen (whichever is less) of each field-replaceable control module, driver, ballast, or individual fixture transformer. For fixtures with non-easily replaceable control gear provide 5 percent or one dozen (whichever is less) extra fixtures. Confirm non-replaceable products during submittal process.
 3. Adjustable accent lights (track, recessed, or surface mounted): 10 percent of each beam angle lens (or removable lens accessory), 10 percent or one dozen (whichever is less) additional accessory lenses, color filters, louvers, and other accessories specified for use during final focusing.
 4. For non-decorative LED lights, provide 2 percent additional fixtures, or minimum two fixtures.
 5. Touch-Up Paint: 2 gallons, to match color of pole finish.

2.12 DISPOSAL AND REPLACEMENT

- A. LED manufacturer is responsible for the disposal of expired LED arrays and heat sinks. Clearly label fixture with return information, disposal procedures and manufacturer disposal contact information.
- B. Owner will pay for shipping.
- C. Manufacturer is required to inform the Owner of new power requirements and /or lumen output values if new replacement components prior to shipping replacement parts.
- D. Label disposal and replacement information inside the luminaire and in the project operation and maintenance manuals along with O&M requirements listed in Division 01, General Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Meet general requirements of NFPA 70, National Electric Code.
- B. Mounting heights specified on drawings:
1. Wall Mounted Luminaires:

- a. Centerline of luminaire.
2. Pendant Mounted Luminaires:
 - a. Bottom of luminaire unless specifically identified in the Luminaire Schedule or on drawings.
- C. Support:
 1. Support by separate means from the building structure and not from the ceiling system, ductwork, piping, or other systems.
 2. Final decision as to adequacy of support and alignment will be given by the Architect.
- D. Power Supplies:
 1. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 - a. Ambient temperature: -4 degrees to 122 degrees F.
 - b. Relative humidity: Maximum 90 percent, non-condensing.
 - c. Protected from dust and excess moisture during installation.
 2. Install per manufacturers prescribed methods.
 3. Located remote mounted power supplies and transformers within the distance limitations specified by the power supply manufacturer.
- E. Level luminaires, align in straight lines, and locate as shown on the architectural elevations and reflected ceiling plan.
- F. Manufacturer's labels or monograms not visible after luminaire is installed, but must be included for future reference.
- G. Recessed Luminaires:
 1. Trims which fit neatly and tightly to the surfaces in which they are installed without light leaks or gaps.
 2. Install heat resistant non-rubber gaskets to prevent light leaks or moisture from entering between luminaires trim and the surface to which they are mounted.
- H. Pole Luminaires:
 1. Provide cast-in-place concrete foundations for pole mounted luminaires.
 2. Concrete: As specified in Division 03, Concrete.
 3. Foundation Forms: As indicated.
 4. Place anchor bolts in foundation as recommended by manufacturer in the required bolt circle size.
 5. Tie reinforcing steel in foundation to the anchor bolts to form a solid cage.
 6. Tamp wet concrete during pouring to assure complete coverage below, around and within the cage and form.
 7. Hand finish top of foundation to produce a smooth, level surface.
 8. Provide a minimum 10-foot copper-clad steel ground rod at each pole base. Connect from ground rod to the ground lug in the pole with minimum AWG 8 copper conductor.
 9. Install pole mounted luminaires plumb with luminaires level, and with reflector distribution in the direction indicated in the Drawings.
 - a. Grout around the pole base at the foundation to close openings.
 - b. Install pole base cover over exposed installation hardware.
- I. Tungsten Halogen Lamps:
 1. When lamping tungsten halogen luminaires use silk gloves to insert lamps.
 2. Do not energize tungsten halogen luminaires during construction to prevent dust build up on lamp, socket and lamp chamber. Lamping occurs as last stage of construction.

3.02 COORDINATION OF WORK

- A. Architectural Reflected Ceiling Plans take preference as to the exact placement of the luminaires in the ceiling.

- B. Determine ceiling types in each area and provide suitable accessories and mounting frames where required for recessed luminaires. Luminaire catalog numbers do not necessarily denote specific mounting accessories for type of ceiling in which a luminaire may be installed.

3.03 AIMING

- A. Aim luminaires with proper lamps installed.
- B. Aim directional luminaires, including but not limited to luminaires described in the Contract Documents or by the luminaire manufacturer as aimable, adjustable, or asymmetric as follows:
 - 1. Provide the lighting pattern for which the luminaire is designed.
 - 2. Provide the lighting pattern as shown on the drawings.
 - 3. Predetermined aiming points as shown on the drawings.
 - 4. Where aiming cannot be determined, request, in writing, clarification from the Architect, indicating luminaires needing clarification.
- C. Re-aim luminaires as determined by Architect during final project walkthrough.
- D. Install adjustable luminaires with dead zone of rotation away from intended aiming point

3.04 PROJECT CLOSEOUT

- A. Leave luminaires clean at the time of acceptance of the work. If luminaires are deemed dirty by the Architect at completion of the work, clean them at no additional cost. Protective plastic wrap is to be removed from parabolic luminaires just prior to Owner acceptance.
- B. Provide fixtures with new lamps operating at time of final acceptance. Exception: For fluorescent dimming fixtures, provide minimum 100 hour/maximum 200 hour, continuously lit lamps or per ballast manufacturer's recommendations.
- C. Where incandescent lamps are used for construction lighting, replace the lamps with new lamps just prior to occupancy by the Owner.

END OF SECTION

**SECTION 26 51 00
LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Drivers.
- C. Emergency power supply units.
- D. LED Modules.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. ANSI O5.1 - American National Standard for Wood Poles - Specifications and Dimensions; 2008.
- B. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- D. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000(R2005) (ANSI/IES RP8).
- E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- F. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- G. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- L. UL 1598 - Luminaires; 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 30 00 - 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.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 1. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
 2. LED Modules: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
 3. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report for proposed substitutions.
- D. Certificates for Fluorescent Dimming Ballasts and LED Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.
- E. Coefficients of Utilization by an approved testing laboratory.
- F. LED Module and driver type for each fixture.
- G. Groups of fixtures with the same LED Module and driver type may reference a single set of submittal documents.
- H. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

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. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

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 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all linear fluorescent ballasts, LED Modules and drivers.

PART 2 PRODUCTS

2.01 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Provide accessories and fittings as recommended by manufacturer to properly and completely install and wire fixtures.
- E. Furnish products as indicated in Schedule included on the Drawings.
- F. Provide the complete system of lighting fixtures and LED Modules as shown on the drawings and specified herein. The requirements of all other sections of the specification are equally applicable to the work to be performed under this section.
- G. The fixture catalog numbers listed on the drawing indicate manufacturer, fixture design, appearance, etc., desired. These fixtures shall be modified if necessary to comply with the specification herein. Lighting fixtures specified will be the basis for comparison in the consideration of fixtures of other manufacturers.
- H. All fixture component parts shall be manufactured and/or assembled at the manufacturing plant for shipment in one or more packages.
- I. 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.
- J. Fixtures - General:
 - 1. Finish shall be white baked enamel, unless otherwise specified with a minimum average reflectance of 85% on all exposed and light reflecting surfaces. Steel components shall be prepared for finishing with a 5-step zinc phosphating process.
 - 2. All recessed lighting fixtures installed in fire rated ceiling shall be provided with fire-rated protective covers.
 - 3. All fixtures mounted outdoors or in unheated spaces shall be capable of operating at 0 degrees F.
- K. If fixtures specified herein are discontinued at the time the work is executed, provide suitable substitute fixtures, without additional cost, as directed by the engineer.
- L. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. The Manufacturers required to inform the owner of new power requirements and / or lumen output values if new replacement components prior to shipping replacement parts.
 - 3. Color temperature shall be per the luminaire schedule. The color temperature shall not exceed a +/- tolerance of greater than 2 McAdam Ellipses. Over the life of the luminaire.
- M. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.
- N. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.
- O. Electrical Characteristics: 120 volts, 60 Hz, unless otherwise specified.
- P. Substitutions, unless Otherwise Indicated: See Section 01 60 00 - Product Requirements.

2.02 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

- A. Manufacturers:
 - 1. Philips Emergency Lighting/Bodine: www.bodine.com.
 - 2. Lithonia Lighting: www.lithonia.com.
 - 3. Iota Engineering, LLC: www.iotaengineering.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
 - 5. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by a single manufacturer.
 - 6. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
- B. Description: Self-contained fluorescent 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. LED luminaires.
- D. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the 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. 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.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.
- H. Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for the installed location.
- I. Accessories:
 - 1. Provide compatible accessory remote combination test switch/indicator light where indicated.

2.03 LED MODULES

- A. Manufacturers:
 - 1. As recommended by light fixture manufacturer.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Manufacturer Limitations: Where possible, provide LED modules produced by a single manufacturer.
- B. All LED Modules:
 - 1. Unless explicitly excluded, provide new, compatible, operable LED modules in each luminaire.
 - 2. Verify compatibility of specified LED's with luminaires to be installed. Where LED's are not specified, provide LED's per luminaire manufacturer's recommendations.
 - 3. Minimum Efficiency: Provide LED's complying with all current applicable federal and state LED efficiency standards.

4. Color Temperature Consistency: Unless otherwise indicated, for each type of LED furnish products which are consistent in perceived color temperature. Replace fixtures that are determined by the Architect to be inconsistent in perceived color temperature.
5. Components: UL 8750 recognized or listed as applicable.
6. Tested in accordance with IES LM-79 and IES LM-80.
7. LED Estimated Useful Life: Minimum of 50,000 hours at 70% lumen maintenance, calculated based on IES LM-80 test data.
8. Light Lumen output as indicated on the drawings.
9. CRI of 70 or greater if not otherwise indicated on the drawings.

2.04 POLES

- A. Install lighting poles at locations indicated. Bond luminaires, metal accessories and pole to branch circuit equipment grounding conductor.
- B. Mount poles plumb. Provide shims to adjust plumb. Grout around pole bases. Provide steel or aluminum bolt covers.
- C. Store and handle solid wood poles in accordance with ANSI O5.1.
- D. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

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 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. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Square and rectangular fixtures shall be mounted with sides parallel to building lines and parallel with ceiling lines.
- G. Properly support and align fixtures and provide all necessary steel shapes for support of the fixtures. Recessed fluorescent fixtures shall be supported at opposite corners by steel wire connected to building structure per IBC requirements. Coordinate complete fixture installation with the facility construction.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Emergency Power Supply Units:

1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install in remote location not exceeding manufacturer's recommended maximum conductor length to 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.
- K. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.
- L. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.
- M. Operate light fixtures at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace light fixture components that fail prematurely.
- N. Verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures.
- O. Install light fixtures as recommended by the manufacturer or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection, or angular jointing of fixtures installed in continuous rows.
- P. All lighting fixtures shall be furnished complete with LED Module and driver and all accessories necessary to provide a complete operable fixture.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test emergency power supply 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.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 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.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - 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 LED modules that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

**SECTION 26 81 01
ELECTRIC HEATING UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electric wall heaters.

1.02 RELATED DOCUMENTS

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

1.03 RELATED REQUIREMENTS

- A. Section 26 05 83 - Wiring Connections: Execution requirements for electric connection to units specified by this section.

1.04 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical plan elevations.
- B. Product Data:
 - 1. Submit mechanical and electrical service locations, capacities and accessories or optional items.
 - 2. Provide wiring diagrams for power, signal and control.
- C. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.06 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.
- B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.07 QUALITY ASSURANCE

- A. Perform Work in accordance with applicable codes.
- B. Electrical components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Provide product delivery, storage, and handling under the provisions of Section 01 60 00.
- B. Accept units on site in factory packing. Inspect for damage. Store under roof.
- C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.09 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Provide product warranties and product bonds under the provisions of Section 01 70 00.
- B. Provide one year factory warranty from date of substantial completion covering parts, materials and labor.

PART 2 PRODUCTS

2.01 ELECTRIC WALL HEATERS

- A. Manufacturers:
 - 1. King; Model PAW Series: www.king-electric.com.
 - 2. Markel: www.markel-products.com.
 - 3. Cadet: www.cadetco.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Approval: Heaters shall be listed and approved by Underwriters Laboratories.
- C. Elements: Assemblies shall be constructed of coiled nickel chromium alloy, corrosion resistant wire strung through a minimum of four rows of mica insulator. Element assemblies shall have factory provided connection to allow field modification to 50% wattage.
 - 1. Wall Can: The wall can shall be 22 gauge electro-galvanized steel and shall contain knockouts through which power leads are brought. The wall can shall be provided with a depth gauge, extending the full length of the wall can. The wall can shall be supplied with a factory installed grounding wire. Minimum Clearance to Floors and Sidewalls. Zero clearance to combustibles.
- D. Grill: The grill shall be louvered, one piece design with rounded edges on all four sides, with rounded corners to prevent snags from contact with other materials. The grill shall be epoxy powder coated in the color specified on the by manufacture.
- E. Fan and Motor: Motor shall be shaded pole, permanently lubricated, C-frame type with impedance protection and sealed bearings. Motors shall be the same voltage as the heater. The motor and all wiring shall be totally isolated from the heating chamber for protection from heated air. The motor shall be equipped with a dynamically balanced four bladed aluminum impeller fan, located in the upper portion of the heatbox, and shall provide a down-flow heating pattern.
- F. Thermal Overload: Heaters shall be equipped with thermal overload SMART LIMIT PROTECTION™, which disconnects elements and motor in the event normal operating temperatures are exceeded. If thermal overload trips due to abnormal operating temperatures, thermal overload shall remain open until manually reset by turning the heater off for fifteen minutes. Automatic reset thermal overloads, which allow the element to continue to cycle under abnormal conditions will not be accepted.
- G. Control: Remote, line voltage, positive off, bi-metal, wall-mounted thermostat. King #K602 Series, Markel, Cadet, or approved.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Comply with provisions under Section 01 30 00 - Administrative Requirements.
- B. For recessed units, verify recess dimensions are correct size.
- C. Verify wall construction is ready for installation.
- D. Verify concealed blocking and supports are in place and connections are correctly located.

3.02 INSTALLATION

- A. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

- B. Protection: Install finished cabinet units with protective covers during remainder of construction.
- C. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals.

3.03 CLEANING

- A. Provide cleaning under the provisions of Section 01 70 00 - Execution and Closeout Requirements.
- B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 27 13 43
STRUCTURED CABLING FOR VOICE AND DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Telecommunications service entrance to building(s).
- B. Cabling and pathways inside building(s).
- C. Distribution frames, cross-connection equipment, enclosures, and outlets.
- D. Grounding and bonding the telecommunications distribution system.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.

1.03 SCOPE

- A. This section describes the products and execution requirements relating to furnishing and installation of telecommunications cabling and termination components and related sub-systems as part of a structured cabling system. Vertical (backbone) and horizontal (station) cabling comprised of both copper and fiber optic cabling are covered under this document.
- B. The horizontal (station) cabling system is based on the installation of Category 6, 4-pair Unshielded Twisted Pair (UTP) for both data and voice copper cables. The cables to be installed from the Telecommunications Outlet to the Intermediate Distribution Frame (IDF)/Telecommunications Closet (TC), Main Distribution Frame (MDF), or Equipment Room (ER) serving that area and terminated as specified in this document. This may be supplemented with cabling in selected areas.
- C. Station cables to be installed in conduit, and/or free-air. Telecommunications Outlets to be mounted flush.
- D. Backbone copper and fiber optic cables to be installed in conduit in building riser pathways and/or free-air as determined by the Project Coordinator or identified on the drawings. Backbone intra-building fiber optic cabling to be installed via inner duct conduit. Refer to the sub-section below which details inner duct requirements. Provide plenum rated cable when routing in plenum spaces.
- E. Provide labor and materials necessary to construct the system as described herein and on the drawings. This includes, but is not limited to, furnishing and installing cable, cable supports, inner duct, racking and termination components, termination, testing, labeling and documentation. Installed system shall be fully functional and ready for use.

1.04 REFERENCE STANDARDS

- A. BICSI TDM Manual - Telecommunications Distribution Methods Manual; Building Industry Consulting Service International, Inc.; 2009.
- B. EIA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Association; Revision D, 1992.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; Rev A, 1988(R 2002).
- E. TIA-526-7 - OFSTP-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant; 2002.
- F. TIA-526-14 - OFSTP-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; Rev A, 1998(R2003).

- G. TIA/EIA-568-B.1 - Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements; Rev B, 2001; Addenda 1-7.
- H. TIA/EIA-568-B.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Rev B, 2001; Addenda 1-11.
- I. TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables; Rev B, 2000; Addendum 1.
- J. TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; 2009.
- K. TIA-570 - Residential Telecommunications Infrastructure Standard; 2009.
- L. TIA/EIA-606 - Administration Standard for the Telecommunications Infrastructure; Rev A, 2002.
- M. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.
- N. UL 444 - Communications Cables; 2002.
- O. UL 497 - Standard for Protectors for Paired-Conductor Communications Circuits; 2001.
- P. UL 514C - Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; 1996.
- Q. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords; 2001.
- R. UL 1863 - Standard for Communications-Circuit Accessories; 2004.
- S. USDA RUS 345-83 - Gas Tube Surge Arrestors (PE-80); US Department of Agriculture; 1982.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Storage and handling requirements and recommendations.
 - 2. Installation methods.
- C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding.
- D. Manufacturer Qualifications.
- E. Installer Qualifications.
- F. Test Plan: Complete and detailed plan, with list of test equipment and procedures for inspection and testing; submit at least 60 days prior to intended test date.
- G. Field Test Reports: Provide one copy to Owner and one copy to engineer of record two weeks prior to final commissioning/observations.
- H. Project Record Documents: Provide two sets, one for Owner and one for engineer of record of 1/8 inch = 1' 0" scale drawings.
 - 1. Record actual locations of outlet boxes and distribution frames.
 - 2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
 - 3. Identify distribution frames and equipment rooms by room number on contract drawings.
 - 4. Identify all telecommunications locations per labeling in 3.03, F.
- I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents and shop drawings.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.
- B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:

1. Supervisors and installers factory certified by manufacturers of products to be installed.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F, the cable to be moved to a heated (50 degrees F minimum) location.
- B. Keep stored products clean and dry. If necessary, cable to be stored off site at the Contractor's expense.

1.08 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.
- B. The Contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion.
- C. The Contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.
- D. The Contractor shall facilitate a minimum 20-year system performance warranty between the manufacturer and the Owner. An extended component warranty shall be provided which warrants functionality of all components used in the system for a minimum of 20 years from the date of acceptance. The performance warranty shall warrant the installed 250 MHz horizontal copper, and both the horizontal and the backbone optical fiber portions of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in ANSI/TIA/EIA-568-B.2-1 (latest draft). Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in ANSI/TIA/EIA-568-B.1.
- E. The Contractor shall furnish an hourly rate with the proposal submittal which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall not void the Contractor's nor manufacturer's warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. These specifications use a single manufacturer's name, model, or catalog number herein for the purpose of establishing a product set. An equivalent for the specified product set may be used upon approval by the architect or engineer of record.
- B. Approved manufacturers:
 1. Panduit/General Cable: www.panduit.com/www.generalcable.com.
 2. Commscope Systimax: www.commscope.com/systimax.
 3. Hubbell/Draka Comteq: www.hubbell-premise.com/www.drakacomteq.us.

2.02 SYSTEM DESIGN

- A. Provide a complete permanent system of cable and pathways for voice and data communications, including conduits and wireways, pull wires, support structures, enclosures and cabinets, rough-in boxes, and conduit sleeves.

1. Comply with TIA/EIA-568 and TIA/EIA-569, latest editions.
2. Comply with TIA-570, latest edition.
3. Provide fixed cables and pathways that comply with NFPA 70 and ANSI/J-STD-607 and are UL listed.
4. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
5. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
6. Capacity: As required to terminate all cables plus minimum 25 percent spare space.

2.03 PATHWAYS

- A. As specified in Section 27 05 28 - Pathways for Low Voltage Systems Cabling.

2.04 BACKBONE CABLE

- A. Optical Fiber: 6-strand, single mode, orange jacket.
 1. Install in inner-duct.
- B. Service Provider Cable:
 1. Furnished by provider, installed by contractor.

2.05 HORIZONTAL CABLE

- A. Copper Cable (voice and data):
 1. TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), AWG, individually twisted pairs; covered with blue jacket.
 - a. In locations other than in plenums, provide NFPA 70 type CMG general purpose, CMR riser-rated, or type CMP plenum-rated cable.
 - b. In plenums, provide NFPA 70 type CMP plenum-rated cable.
 - c. Manufacturer: Uniprise.
 - 1) Model: 65N4.

2.06 TELECOMMUNICATION OUTLETS

- A. Faceplates:
 1. Angled faceplate constructed of ABS moulding compound, quantity of ports to math configuration. Each port shall be provided with an icon to indicate its function. Faceplate shall accommodate two labels and provide a clear polycarbonate cover for each. All unused port positions shall have a blank insert installed. Faceplate ports shall be populated left to right, top to bottom.
 2. Color: As selected by Architect.
 3. Manufacturer: Uniprise.
- B. Modular jacks:
 1. All modular jacks shall be wired to the T568A or T568B wiring pattern. Modular jacks shall be constructed with a housing of polyphenylene oxide, 94V-0 rated. Modular jacks shall be terminated using a 110-style pc board connector (made of 94V-0 rated polycarbonate), color-coded for both T568A and T568B wiring. The 110 connector shall terminate 22-24 AWG solid conductors with a maximum insulation diameter of .05 inch. The modular jack contacts shall be plated with a minimum of 50 micro inches of gold in the contact area over a 50 micro inch minimum nickel underplate. Modular jacks shall be UL Listed.
 2. Color: As selected by Owner.
 3. Manufacturer: Uniprise.
- C. Standard Configurations:

1. Unless otherwise noted, all locations shall be provided with 1, 2, 3, or 4 Category 6 UTP cables terminated on Category 6 modular RJ-45 jacks.
2. Wireless Access Point:
 - a. 1 - Category 6 UTP cable terminated on Category 6 modular RJ-45 jacks.
3. Dedicated Phone:
 - a. 1 - Category 6 UTP cable terminated on Category 6 modular RJ-45 jacks.

2.07 CROSS-CONNECTIONS AND ADAPTORS

- A. Fiber Optic Terminal Enclosures:
 1. Backbone Cable:
 - a. Each fiber optic cable shall be terminated in the building MDF or IDF in appropriately sized rack mount patch enclosures (RMPE), providing protection for the terminated fibers. Contractor shall provide an appropriate number of RMPEs to accommodate project's installed fiber. The MDF enclosure shall accommodate project's installed fiber, plus an allowance for future growth equal to 50 percent of the installed capacity.
- B. Fiber Optic Adaptors:
 1. All fiber optic cable, whether single mode or multi-mode, shall be terminated using SC style fiber optic connectors.
 2. For multi-mode applications, SC connectors shall be 50/125 μm or 62.5/125 μm (to match cable) multi-mode connectors, capable of terminating either 250 μm coated or 900 μm buffered fibers. The connectors shall be field-installable, requiring no epoxy or polishing.
 3. For single mode applications, fiber shall be terminated using a fan-out kit or pigtail.
- C. Patch Panels for Fiber Optic Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum.
 1. Adaptors: Maximum of 24 duplex adaptors per standard panel width.
 2. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606-A using encoded identifiers.
 3. Provide incoming cable strain relief and routing guides on back of panel.
 4. Provide rear cable management tray at least 8 inches deep with removable cover.
 5. Provide dust covers for unused adaptors.
 6. Patch Panels for Data Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
 - a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
 - b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
 - c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606-A using encoded identifiers.
 - d. Manufacturer: Uniprise.

2.08 EQUIPMENT RACKS AND ENCLOSURES

- A. Floor Mount (Open):
 1. Telecommunications Termination Rack: 7'H x 19"W; High strength lightweight aluminum construction E/W universal 5/8" - 5/8" - 1/2" alternating hole pattern. EIA channel: 6" x 1.25" x 1/4" thick flange, Base Angle: 3.5" x 6" x 3/8", Top Angle: 1.5" x 1.5" x 1/4", Top Bar: 1.5" x 1/4". Includes assembly and floor mounting hardware.
 2. Manufacturer: Chatsworth Products, Inc., or approved equivalent.
- B. Wire Management:

1. Provide wire management in the following equipment rack configurations:
 - a. Floor mount (open):
 - 1) Vertical Wire Management: Chatsworth Products, Inc. black Combination Cabling Section (CCS). For single rack installations, mount a 6"W x 7'H x 12.24"D CCS (CPI part #30162-703) on each side of the rack. Where multiple racks abut, mount a 10"W x 7'H x 12.24"D CCS (CPI part #30163-703) between the racks and 6"W x 7'H x 12.24"D CCS (CPI part #30162-703) on each end of the ganged rack assembly.
 - 2) Horizontal Wiring Management: Chatsworth Products, Inc. black Universal Horizontal Cable Manager. Provide 19"W x 2U x 5.14"D cable managers (CPI Part #30130-719).
 - C. Dwelling Unit Media Panel:
 1. 30"H x 14"W. WIFI transparent media panel. Standard depth.
 2. Manufacturer: Primex; Model P3000 Series.
 - D. Ladder Racks:
 1. Manufacturer:
 - a. Chatsworth Products, Inc.; Model 10250-718 (18" wide rack): www.chatsworth.com.
 2. Tubular steel bar type cable racks with 0.065" thick side rails. 1.5" high x 0.375" wide stringers. 1.5" wide x 0.375" high rungs set 12" on center. Widths as noted.
 3. Complete with all necessary supports, hangars, connectors, nuts, bolts, etc., necessary for a complete installation.
 4. Ladder racks shall be supported a minimum of every 5 feet on center and at the end of every ladder rack run, utilizing trapeze type supports (as recommended by the manufacturer), attached directly to the structure above. Provide wall angle support kits where ladder rack terminates at wall.
 5. Provide end-closing kits on all ladder rack ends.
 6. Ladder racks shall be installed at 7'0" AFF to underside of ladder, unless otherwise noted.
 7. Coordinate placement of ladder racks and supports with duct work, conduits, piping, lighting fixtures, etc.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Comply with latest editions and addenda of TIA/EIA-568, TIA/EIA-569, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
- B. Comply with latest editions and addenda of TIA-570, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

3.02 INSTALLATION OF EQUIPMENT AND CABLING

- A. Cabling - General Requirements:
 1. Do not install cable into conduits until conduit installation is complete.
 2. Do not over-cinch or crush cables.
 3. Do not exceed manufacturer's recommended cable pull tension and minimum bend radii.
 4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
 5. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.
 6. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document where cable splices are not allowed.

7. Cable shall be supported in conduit or cable tray where applicable. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
 8. Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
 9. Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs is required, the contractor shall install clips to support the cabling.
 10. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
 11. All backbone cables shall be installed in the following manner:
 - a. Backbone cables shall be installed separately from horizontal distribution cables.
 - b. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate innerducts within conduits.
 - c. Where cables are installed in an air return plenum, the cable shall be installed in conduit, or plenum cable shall be installed in a plenum innerduct to provide protection to the cable
 - d. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- B. Fiber Optic Cabling:
1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
 2. Support vertical cable at intervals as recommended by manufacturer.
 3. Cable shall be installed in minimum 1 inch corrugated style innerduct enclosing the fiber optic cable in its entirety from termination to termination.
 4. All strands are to be connected and tested. No strands are to be left 'dark'. Manufacturer's specifications for bend radii are to be strictly observed. Any instance where the bend radius of the optical cable must exceed that which is manufacturer specified or recommended shall immediately be brought to the attention of the Architect.
 5. All fiber optic cable (and encasing innerduct) is not to be bound, wrapped, or otherwise secured to the copper twisted pair cable at any point, except as where the copper cable and innerduct may be commonly attached to a wall, and hence commonly supported by a wire hanger, or other approved mechanism.
 6. Fiber slack shall be neatly coiled within the fiber termination panel. No slack loops shall be allowed external to the fiber panel(s).
 7. Each cable shall be individually attached to the respective termination panel by mechanical means. The cables strength member(s) shall be securely attached the cable strain relief bracket in the panel.
 8. Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the termination panel.
 9. Each cable shall be clearly labeled at the entrance to the termination panel. Cables labeled within the bundle shall not be acceptable.
 10. Dust caps shall be installed on the connectors and couplings at all times unless physically connected.

11. Fiber optic hardware and terminations shall be performed by a technician who has either successfully completed a manufacturer's training course for terminating and maintaining fiber optic cable, or has successfully completed such a training program offered by an authorized distributor of optical cable and termination products.
 12. A 20-foot slack loop of fiber optic cable shall be left at the MDF and IDF prior to the cable entering any termination hardware.
 13. Splicing: All fiber routed between MDF and IDF is to be one continuous length, without exception. No splices are to be performed.
- C. Copper Cabling:
1. All outlets shall be installed in the following manner: Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12 inches of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
 2. Enough slack shall be stored in ceiling space for outlet to be relocated to furthest location in the room from the feeding IDF.
 3. In addition, each cable type shall be terminated as indicated below:
 - a. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-A or ANSI/TIA/EIA-568-B document, manufacturer's recommendations, and/or best industry practices.
 - b. Pair untwist at the termination shall not exceed 0.25 inch from Category 6 connecting hardware.
 - c. The cable jacket shall be maintained as close as possible to the termination point.
 4. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables. Cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle.
 5. UTP cable shall be installed so that there are no bends less than four times the outside diameter (4 x cable O.D.) at any point in the run. FTP cable shall be installed so that there are no bends less than 8 times the outside diameter (8 x cable O.D.) at any point in the run.
- D. Equipment Racks and Enclosures:
1. Racks shall be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 7 inches to the wall to allow room for vertical wire management hardware. Where more than one rack is to be installed, the racks shall be ganged with vertical wire management hardware to provide inter-bay management. Ganged rack frames will be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side of the ganged assembly.
 2. Racks shall be securely attached to the concrete floor using 3/8 inch hardware.
 3. All racks shall be grounded to the telecommunications ground bus bar.
 4. Rack mount screws (#12-24) not used for installing panels and other hardware shall be bagged and left with the rack upon completion of the installation.
 5. All installed racks shall comply with regional seismic requirements and I.B.C.
 6. Wall mount racks shall be mounted on plywood backboard.

- E. Field-Installed Labels: Comply with TIA/EIA-606-A using encoded identifiers.
 - 1. Contractor shall submit for approval by Owner a proposed labeling system based on the above standard.

3.03 FIELD QUALITY CONTROL

- A. Visual Inspection:
 - 1. Inspect cable jackets for certification markings.
 - 2. Inspect cable terminations for color coded labels of proper type.
 - 3. Inspect outlet plates and patch panels for complete labels.
 - 4. Inspect patch cords for complete labels.
 - 5. Inspect cable termination to validate that cables were dressed and terminated in accordance with ANSI/TIA/EIA specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are dressed in a neat and orderly fashion.
- B. Testing - Fiber Optic Cabling:
 - 1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests. Post-installation tests shall be per ANSI/TIA/EIA 568-B.3 Standard.
 - 2. Multimode Backbone: Perform tests in accordance with TIA/EIA-526-14 Method B.
 - 3. Single Mode Backbone: Perform tests in accordance with TIA-526-7 Method B.
 - 4. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.
- C. Testing - Copper Cabling and Associated Equipment:
 - 1. Testing will be completed per Industry Standard for cable type to be tested. TIA/EIA-568-B.2-1 (Category 6), ISO/IEC 11801:2002 2nd Edition (classes D, E and F).
 - 2. Test backbone cables after termination but before cross-connection.
 - 3. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
 - 4. Test operation of shorting bars in connection blocks.
 - 5. Category 3 Backbone: Perform attenuation test.
 - 6. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational and ring-back, and dial tone.
 - 7. Category 6 Backbone: Perform near end cross talk (NEXT) and attenuation tests.
 - 8. Category 6 Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.
- D. Testing - Documentation:
 - 1. The Contractor shall compile test results into forms that contain all applicable test data. All forms shall be neatly completed and legible when submitted. Hard copy optical traces shall be neatly and securely attached to the test results where indicated. Computer disks containing trace files will be submitted at the same time.
- E. Test Verification:
 - 1. Upon receipt of the test documentation, The Owner reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Owner testing will use the same method employed by the Contractor, and minor variations will be allowed to account for differences in test equipment. If significant discrepancies are found, the Contractor will be notified for resolution.

F. Final Inspection:

1. Upon completion of the project, The Owner's Technical Representative will perform a final inspection of the installed cabling system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Owner.

END OF SECTION

SECTION 27 51 30
ACCESSIBLE ELEVATOR LANDING TWO WAY COMMUNICATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Master Station
 - 2. Area Stations
 - 3. Conduit, Wiring/Cable System

1.02 RELATED SECTIONS

- A. Contents of Division 27 - Communications and Division 01 - General Requirements as they apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Division 27 - Communications and Division 01 - General Requirements.
 - 1. Meet requirements of NFPA 72, National Fire Alarm and Signaling Code.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.
- B. In addition, provide:
 - 1. Shop Drawings to include the following:
 - a. Complete system wiring connection diagrams, wiring connection details.
 - b. Show a detailed riser diagram.
 - c. Show an equipment block diagram indicating the number and gauge of the conductors used.
 - d. Show wiring connection details for the components being connected to the system and interface to the associated equipment.
 - e. Show on the floor plans symbol key with device catalog number, description, dimensions, back box size and mounting requirements.
 - f. Complete sequence of operation.
 - g. Indicate system components, size of components and location.
- C. Submit, prior to final acceptance, a letter confirming that inspections have been completed and the system is installed and functioning in accordance with the Specifications. Include manufacturer's representative's certification of installation and letter of warranty.
- D. Operation and Maintenance Manuals: Provide manuals containing the following:
 - 1. Catalog cut sheets.
 - 2. System components, master stations and area stations installation sheets.
 - 3. Manufacturer's installation, operation and maintenance manual.
 - 4. Record drawings.
 - 5. Record drawings on electronic media storage.
 - 6. Warranty agreement including parts and labor.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 01 40 00.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Division 27 - Communications and Division 01 - General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Furnish equipment specified in this Section by one manufacturer if they can meet the requirements of these Specifications.
- B. MASTER STATION:
 - 1. Cornell 4800 Series.
 - 2. Rath 2500 Series.
 - 3. Or approved equivalent.
- C. Area Stations
 - 1. Cornell 4800 Series.
 - 2. Rath 2500 Series.
 - 3. Or approved equivalent.

2.02 MASTER STATION

- A. Flush-mounted station; tamperproof mounting hardware.
- B. Capability to interface with standard telephone system and dial a minimum of two phone numbers.
- C. Stainless steel construction.
- D. Panel capacity for the number of Area Stations required by the larger of the quantity indicated in the Contract Documents or as required by code. Two buttons ("TALK," "LISTEN") per Area Station to initiate and respond to request for assistance from each specific Area Station in the system.
- E. System Operation:
 - 1. Illuminate "green" LED to indicate the system is operational during standby mode.
 - 2. Depressing the "TALK" button illuminates a status change LED at the respective Area Station, silence the piezoelectric alarm and open up two-way voice communication between the Master Station and Area Station(s).
 - 3. Two LEOs per Area Station to visually indicate "HELP REQUESTED" (red LED) or a line fault (amber LED) for each specific Area Station in the system and to indicate that a fault has occurred at a particular Area Station(s), wiring between Area Station(s) and Master Station, or other system components.
 - 4. An audible alarm signal sounding through the Master Station to indicate "HELP REQUESTED" from an Area Station.
 - 5. Generate an audio confirmation signal from the Master to the Area Station to acknowledge the request for assistance of the "HELP REQUESTED" call from the Area Station to the Master Station is indicated at the Area Station by the illumination of a red LED ("HELP COMING") on the Area Station.
 - 6. Redirect "HELP REQUESTED" call to a secondary Master Station, PBX system, or other outside telephone if there is no answer at the primary Master Station.
 - 7. Provide battery backup.
 - 8. Provide N/O dry contacts for connection to a secondary Master Station, paging system, fire alarm system, or other optional devices such as a dual tone multi frequency (DTMF)

telephone dialer or PBX telephone system. Communication between Master Stations or DTMF telephones is non-blocking.

2.03 AREA STATIONS

- A. Flush-mounted station with tamperproof mounting hardware.
- B. Stainless steel construction with engraved lettering. Red "PUSH FOR HELP" engraved on surface.
- C. Mushroom pushbutton activated with minimum of effort in compliance with the ADAAG and engineered so that it may be depressed from any angle for ease of use provided.
- D. LED to indicate status, labeled "HELP REQUESTED".
- E. Integral speaker to transmit/receive voice. Tone to indicate the alarm has been received at the master station.
- F. An alarm signal sounding through the Area Station to aurally indicate "HELP REQUESTED" from an Area Station.

2.04 CONDUIT, WIRING/CABLING SYSTEM

- A. Provide wiring/cabling as required by the manufacturer.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. General:
 - 1. Obtain approval of system design from AHJ prior to installation. Do not begin installation without approval from AHJ and submittal review comments from Engineer.
 - 2. Install in accordance with applicable codes, NFPA 72, NFPA 70 and the Contract Documents.
 - 3. In accordance with manufacturer's instructions, provide wiring, conduit and outlet boxes required for the assemblage of a complete system as described in these specifications, as shown on Drawings and as required by AHJ.
 - 4. Conceal wiring, conduit, boxes and supports where installed in finished areas.
 - 5. Provide two-hour fire rated cabling and conduit system.
 - 6. At junction boxes and termination points, provide identification tags on wires and cables.
 - 7. Obtain Architect's or Owner's approval of locations of devices, before installation.
 - 8. Install signs required by ADA and the building code.
 - 9. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.
- B. Design Criteria:
 - 1. Provide design of Area-of-Refuge Two-Way Communication System as required in these Contract Documents.
 - 2. This is a bidder designed system. Contact AHJ prior to bid to verify Area of Refuge Two-Way Communications requirements. Provide design compliant with codes as interpreted by the AHJ.
- C. Inspection and Testing for Completion:
 - 1. System testing and commissioning to be performed by a certified manufacturer representative.
 - 2. Perform inspection and testing in accordance requirements of local authorities; document each inspection and test.

3. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction and adjustments.
 4. Provide tools, software and supplies required to accomplish inspection and testing.
 5. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required to test system.
 6. Correct defective work, adjust for proper operation and retest until entire system complies with Contract Documents.
 7. Notify Owner seven days prior to beginning completion inspections and tests.
 8. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
 9. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least fourteen days without any system or equipment malfunctions.
 - a. Record all system operations and malfunctions.
 - b. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 - c. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
- D. Owner Personnel Instruction:
1. Provide the following instruction to designated Owner personnel:
 - a. Hands-On Instruction: On-site, using operational system.
 - b. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
 - c. Factory Instruction: At control unit manufacturer's training facility.
 2. Basic Operation: One-hour sessions for attendant personnel, security officers and engineering staff; combination of classroom and hands-on:
 - a. Initial Training: One session pre-closeout.
 - b. Refresher Training: One session post-occupancy.
 3. Detailed Operation: Two-hour sessions for engineering staff; combination of classroom and hands-on:
 - a. Initial Training: One session pre-closeout.
 - b. Refresher Training: One session post-occupancy.
 4. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data and record drawings available during instruction.
 5. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.
- E. Closeout:
1. Closeout Demonstration:
 - a. Demonstrate proper operation of all functions to Owner.
 - b. Be prepared to conduct any of the required tests.
 - c. 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.
 - d. Have authorized technical representative of control unit manufacturer present during demonstration.
 - e. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ in time to schedule demonstration.
 - f. Repeat demonstration until successful.

2. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
 - a. Specified diagnostic period without malfunction has been completed.
 - b. Approved operating and maintenance data has been delivered.
 - c. All aspects of operation have been demonstrated to Owner.
 - d. Final acceptance of the fire alarm system has been given by AHJ
 - e. Occupancy permit has been granted.
 - f. Specified pre-closeout instruction is complete.
3. Perform post-occupancy instruction within three months after date of occupancy.

3.02 MASTER STATION

- A. Install per manufacturer's instructions and recommendations.
- B. Mounting Height: Mount the master telephone station enclosure 48-inches above finished floor.

3.03 AREA STATIONS

- A. Install per manufacturer's instructions and recommendations.
- B. Mounting Height: Mount the area of refuge station so the bottom of the enclosure is 38-inches above finished floor.

3.04 CONDUIT, WIRING/CABLE SYSTEM

- A. In accordance with the manufacturer's instructions. Provide wiring, conduit and outlet boxes required for the erection of a complete ADA compliant communication system.
- B. Provide wiring to meet the requirements of the NEC, OESC, and AHJ. Wires tagged at junction points and tested free from grounds or crossed between conductors.
- C. Provide final connections between equipment and the wiring system approved by manufacturer.
- D. Provide wiring to meet the requirements of national, state and local electrical codes. Provide color coded wiring as recommended and specified by the manufacturer.
- E. Route wiring to avoid blocking access to equipment requiring service, access, or adjustment.

END OF SECTION

**SECTION 28 10 00
ACCESS CONTROL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access control system requirements.
- B. Access control point peripherals, including readers and keypads.
- C. Access control software.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware: Electrically operated door hardware, for interface with access control system.
- B. Section 14 21 00 - Electric Traction Elevators: For interface with access control system.

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. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- D. Test Reports: Indicate satisfactory completion of required tests and inspections.
- 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 operation of product.
- F. Manufacturer's detailed field testing procedures.
- G. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.
- H. Operation Data: Operating instructions.
- I. Maintenance Data: Maintenance and repair procedures.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Deliver blank credentials to Owner as directed.

1.05 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70.
 - 2. The requirements of the local authorities having jurisdiction.
 - 3. Applicable TIA/EIA standards.
- B. Conform to requirements of NFPA 70.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- D. 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.
- E. Products: Furnish products listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Access Control System Software, Controllers, and Input Devices:
 - 1. Latch Series.
 - 2. Substitutions: Not permitted.
- B. Telephone Entry System:
 - 1. Latch.
 - 2. Substitutions: Not Permitted.

2.02 ACCESS CONTROL SYSTEM REQUIREMENTS

- A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. 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.
- C. Access Control System: Control access to building and selected areas using encoded fobs:
 - 1. Exterior Doors: Control access into and out of building.
 - 2. Building Areas: Control access into and out of amenity spaces, storage, offices, or other areas as defined on the plans.

2.03 ACCESS CONTROL AND ALARM MANAGEMENT SYSTEM

- A. Server-based software application platform capable of monitoring and managing complete access control device database.
- B. Centrally managed system for multi-building controlled access device employment.
- C. Provides licenses for quantity of controlled doors and end devices specified.
- D. Alarm management: view, acknowledge, define, and respond to alarms.
- E. Anti-pass back/anti-tailgating management.
- F. Card holder management, data security, searching, and back-up features.
- G. Control access: control access through door security points.
- H. Data management, data security, searching, and back-up features.
- I. Graphical map interface: capacity to monitor, locate, and control devices from a graphical map.
- J. Produce comprehensive reports of system activity and configuration including history, system configuration, cardholder, access point usage, etc.
- K. Visitor management: includes visitor check-in, access rights, and reporting.
- L. Encryption of data transmitted either wireless or via conductors between controller and security devices.

2.04 ACCESS CONTROL POINT PERIPHERALS

- A. Provide devices compatible with control units and software.
- B. Provide devices suitable for operation under the service conditions at the installed location.
- C. Provide readers compatible with credentials to be used.
- D. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 71 00.

2.05 COMPONENTS

- A. Security Access Control Panel, Accessories for telephone entry, and intercom, and control of card readers.
- B. Encoded Fob (for Common Area Doors) Controllers:
 - 1. Manufacturer: Latch R.
- C. Encoded fob controllers for apartment unit doors: Latch M.
- D. Encoded Fobs:
 - 1. Quantity: 300.
 - 2. Product: TBD
- E. Software: Access Control Software shall be furnished and installed; Latch
- F. System Cable: As recommended by manufacturer.
- G. End Devices:
 - 1. Door Position Switch:
 - a. Sentrol.
 - b. Ademco.
 - c. GE.
 - d. Or approved equal.
 - 2. Request to Exit:
 - a. Bosch DS160.
 - b. Ademco.
 - c. SDC.
 - d. Or approved equal.
- H. Power Supplies:
 - 1. Altronix.
 - 2. Or approved equal.
- I. Touch Screen Intercom:
 - 1. Locate at package rooms and main entries.
 - 2. Manufacturer: Latch.
- J. UPS: Minimum 600VA/300W.
- K. Expansion Boards: Provide as necessary.
- L. Ethernet POE switches, as necessary.

PART 3 EXECUTION

3.01 SEQUENCE OF OPERATIONS

- A. General:
 - 1. Device triggers log applicable information into headend database, including card key information (valid or readable information on non-authorized card keys), door information, and timestamp entry.
 - 2. Configure headend system to allow management to locally or remotely perform full building lockdown.
 - 3. Provide headend database licenses, as required, to support devices shown and functions described.
- B. Door Operations:
 - 1. Doors with Card Readers:
 - a. Presentation of an authorized card read unlocks doors and provides positive visual LED reader feedback.

- b. Presentation of an unauthorized or unreadable card read keeps doors in locked state and provides negative visual LED reader feedback.
 - c. When approached for the secure side the request-to-exit or electrified door hardware detection unlocks doors and shunts door alarm.
 - d. Doors operators trigger motorized door actuators during business hours, and only after authorized card read during non-business hours.
 - 1) Where two sets of entry or exit doors are in parallel, a single operator trigger operates both doors in succession.
 - e. Provide alarm where door position switch is triggered without either previous authorized card read, request-to-exit or electrified door hardware detection.
2. Doors with Door Position Switches Only:
- a. When approached from the secure side the request-to-exit or electrified door hardware detection unlocks doors and shunts door alarm.
 - b. Provide alarm where door position switch is triggered without request-to-exit or electrified door hardware detection.
3. Doors left open (propped open) longer than 20 minutes generates an alarm.
4. Trigger from the smoke control panel unlocks and opens/operates the following doors:
- a. Unlocks egress doors - fail safe operation. Refer to architectural plans and door hardware schedule for doors identified as means of egress.
 - b. Maintains locked doors at entries to loading/receiving areas.
5. Trigger from the fire alarm panel, or upon power loss:
- a. Unlocks egress doors - fail safe operation. Refer to architectural plans and door hardware schedule for doors identified as means of egress.
 - b. Maintains locked doors at entries to loading/receiving areas.

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.
- D. Identify system wiring and components.
- E. Use 14 AWG minimum size conductors for detection and signal circuit conductors.
- F. Make conduit and wiring connections to door hardware devices furnished and installed under Section 08 71 00.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 45 00 - Quality Control, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Prepare and start system in accordance with manufacturer's instructions.
- D. Program system parameters according to requirements of Owner.
- E. Test for proper interface with other systems.
- F. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate normal and abnormal modes of operation, and required response to each.
- B. Provide 2 hours of instruction each for two persons.
 - 1. Conduct instruction at project site with manufacturer's representative.

3.05 MAINTENANCE

- A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.
- B. Provide a separate maintenance contract for specified maintenance service.
- C. Furnish service and maintenance of security access system for one year from Date of Substantial Completion.

3.06 SYSTEM SOFTWARE

- A. Install, configure, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

3.07 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 4 hours to instruct personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications.
- C. Develop separate training modules for the following:
 - 1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
 - 2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
 - 3. Security personnel.
 - 4. Hardware Maintenance Personnel.
 - 5. Corporate Management.
- D. Testing and training compliant Division 01, General Requirements.

END OF SECTION

**SECTION 28 31 00
FIRE ALARM SYSTEM**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Code compliant fire alarm system design and installation, including all components, wiring, and conduit where required per code.
- B. Transmitters for communication with supervising station.
- C. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED SECTIONS

- A. Section 07 84 00 - Firestopping: Materials and methods for work to be performed by this installer.
- B. Section 08 71 00 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- C. Section 14 21 00 - Passenger Elevators: Elevator systems monitored and controlled by fire alarm system.
- D. Section 14 91 00 - Facility Chutes: Sensors and interlocks monitored by fire alarm system.
- E. Section 21 13 00 - Fire Suppression Sprinklers: Supervisory, alarm, and actuating devices installed in sprinkler system.
- F. Section 23 33 00 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 REFERENCES

- A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).
- B. NFPA 70 - National Electrical Code; 2005.
- C. NFPA 72 - National Fire Alarm Code and Signaling Code; 2010.
- D. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2009.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.
- B. Proposal Documents: Submit the following with cost/time proposal:
 - 1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
 - 3. Certification by Contractor that the system design will comply with the contract documents.
 - 4. Proposed maintenance contract.
- C. Drawings must be prepared using AutoCAD Release 2005 (or later).
 - 1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.
- D. Evidence of designer qualifications.
- E. 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; 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 Contractor that the system design complies with the contract documents.
 12. Do not show existing components to be removed.
 13. Shop drawings will need to be stamped by a NICET Level III certified fire alarm technician or signed by supervisor electrician.
- F. Evidence of installer qualifications.
- G. Evidence of instructor qualifications; training lesson plan outline.
- H. Evidence of maintenance contractor qualifications, if different from installer.
- I. 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.
- J. Operating and Maintenance Data: See Section 01 70 00 for additional requirements; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Replacement parts list with current prices, and source of supply.
 6. Detailed troubleshooting guide and large scale input/output matrix.
 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- K. Project Record Documents: See Section 01 70 00 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- L. Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
 3. Certificate of Occupancy.
 4. Written warranty.
 5. Report on training results.
- M. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 63 00 - Product Substitution Procedures Requirements, for additional provisions.
 2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data .
 3. In addition to the items in quantities indicated in PART 2, furnish the following:
 - a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
 - b. Two copies, on CD-ROM, of all software not resident in read-only-memory.
 - c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

1.05 QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
- B. 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.
- C. Installer Qualifications: Firm with minimum 5 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address of certified manufacturer technician.
 4. Contract maintenance office located within 50 miles of project site.
 5. Certified in Oregon as fire alarm installer.
- D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- E. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.

- F. All control equipment must have transient protection devices to comply with UL864 requirements.
- G. In addition to the UL UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760 23.

1.06 WARRANTY

- A. See Section 01 70 00 - Execution and Closeout Requirements, 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 and certified test.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm Control Units - Basis of Design:
 - 1. Honeywell Security & Fire Solutions; Notifier: www.notifier.com.
- B. Fire Alarm Control Units - Other Acceptable Manufacturers: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
 - 1. Honeywell Security & Fire Solutions; Fire Control Instruments, Inc: www.firecontrolinstruments.com.
 - 2. GE Security; EST Series: www.gesecurity.com.
 - 3. Provide all control units made by the same manufacturer.
- C. Initiating Devices, and Notification Appliances:
 - 1. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
 - 2. Same manufacturer as control units.
 - 3. Provide all initiating devices and notification appliances made by the same manufacturer.
- D. Substitutions: See Section 01 63 00 - Product Substitution Procedures Requirements.
 - 1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with contract documents prior to bid.
 - 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 the contract documents or not, for a complete and operable system.
 - 2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. The Americans With Disabilities Act (ADA).
 - b. The requirements of the State Fire Marshal.
 - c. The requirements of the local authority having jurisdiction.
 - d. Applicable local codes.
 - e. The contract documents (drawings and specifications).
 - f. NFPA 101.

- g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
- 3. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
- 4. Master Control Unit (Panel): New, location indicated on drawings.
- 5. Combined Systems: Do not combine fire alarm system with other non-fire systems.
- B. Supervising Stations and Fire Department Connections:
 - 1. Public Fire Department Notification: By remote supervising station.
 - 2. Remote Supervising Station: UL-listed central station under contract to facility.
 - 3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
- C. Circuits:
 - 1. Initiating Device Circuits (IDC): Class B, Style A.
 - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 4.
 - 3. Notification Appliance Circuits (NAC) within single building: Class B, Style Y.
- D. Spare Capacity:
 - 1. Initiating Device Circuits: Minimum 25 percent spare capacity.
 - 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 - 3. Master Control Unit: 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. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
 - 1. Sprinkler water control valves.
 - 2. Dry-pipe sprinkler system pressure.
 - 3. Elevator shut-down control circuits.
 - 4. Chute interlocks and controls.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
 - 1. Sprinkler water flow.
 - 2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
 - 3. Duct smoke detectors.
- C. Elevators:
 - 1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service, control of elevator hoistway relief dumper and 120Volt connection.
 - 2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
 - 3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
- D. HVAC:
 - 1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
- E. Roof deck barbecue grills.
- F. Roofdeck firetables.

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, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
 - 1. Construction shall be modular with solid state, microprocessor based electronics. An 80 character LCD display shall indicate alarms, supervisory service conditions, and any troubles. Panel shall have 250 addressable points with internal dialer.
 - 2. Expansion Power Supplies: Provide as required for notification appliance circuits. Power supply to provide 8 Amps of power, four signal circuits, and battery standby.
- D. Remote Annunciators: Shall be 80 character LCD display and include four programmable control switches, as well as alarm silence, acknowledgment, and system reset switches.
- E. Initiating Devices:
 - 1. Manual Pull Stations: Shall be addressable, dual action, and constructed of high impact, red lexan with raised white lettering and a smooth high gloss finish. Stations which utilize screwdrivers, allen wrenches, or other commonly available tools shall not be accepted. Stations shall be keyed alike with the fire alarm control panel. When the station is operated, the handle shall lock in a protruding manner to facilitate quick visual identification of the activated station.
 - a. Provide 1 extra.
 - 2. Smoke Detectors: Photo electric smoke detectors with base. Each smoke detector shall have its own unique address, analog, and with selectable sensitivity. Detectors shall be listed to UL standard 268 and shall be documented compatible with the control equipment to which it is connected. Detectors shall be listed for this purpose by Underwriters Laboratories Inc. The detectors shall obtain their operating power from the fire alarm panel supervised detection loop. The operating voltage shall be 24VDC (nominal). Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal to be generated at the control panel. Each detector shall have a flashing status indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch. Remote LED alarm indicators shall be installed where indicated.
 - a. Provide 5 extra.
 - 3. Duct Smoke Detectors: Shall be addressable and of the solid state photoelectric type. The detectors shall operate on the light scattering photodiode principle. Detector design shall provide full solid state construction and compatibility with being separately monitored via a unique address via data loop.
 - a. Provide 1 extra.
 - 4. Heat Detectors: Automatic heat detectors shall be combination rate-of-rise and fixed-temperature type. Each heat detector shall have its own unique address.
 - a. Provide 1 extra.
 - 5. Addressable Interface Devices:
 - a. Provide 3 extra.

- F. Notification Appliances:
 - 1. Audible/visible units shall provide a common enclosure for fire alarm audible and visual alarm devices. Models shall be available which provide for horizontal or vertical mounting and with high humidity and strobe synchronization options. The audio/visual combination unit shall provide 4 Wire connection to ensure properly supervised in/out system connection and shall be UL listed for its intended purpose. Device candela shall be rated per current NFPA and ADA requirements.
 - a. Provide 3 extra audible/visible units.
- G. Circuit Conductors: Copper; 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. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
 - 3. 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 2 keys of each type.
- J. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
 - 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 - 2. Provide one for each control unit where operations are to be performed.
 - 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 - 4. Provide extra copy with operation and maintenance data submittal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the system in accordance with the plans and specifications, all applicable codes, and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 A and B. Upon completion, the contractor shall so certify in writing to the owner and general contractor. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.
- E. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.
- F. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- G. The manufacturer's authorized representative shall provide on site supervision of installation.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Owner will provide the services of an independent fire alarm engineer or technician to observe all tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- F. Provide all tools, software, and supplies required to accomplish inspection and testing.
- G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- H. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
- I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
 - 1. Record all system operations and malfunctions.
 - 2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 - 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
 - 4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
- B. Provide a total of 4 hours of initial/refresher training to designated Owner personnel covering issues for the topics below. Duration of individual training sessions as determined by Owner, not to exceed total number of required hours.
 - 1. Administrative: Issues necessary for non-technical administrative staff.
 - 2. Basic/Detailed Operation: Issues necessary for attendant personnel, security officers, and engineering staff.
- C. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

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.
- B. Occupancy of the project will not occur prior to Substantial Completion.

- C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
 - 1. Specified diagnostic period without malfunction has been completed.
 - 2. Approved operating and maintenance data has been delivered.
 - 3. Spare parts, extra materials, and tools have been delivered.
 - 4. All aspects of operation have been demonstrated to Owner.
 - 5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
 - 6. Occupancy permit has been granted.
 - 7. Specified pre-closeout instruction is complete.
- D. Perform post-occupancy instruction within 3 months after Substantial Completion.

END OF SECTION

SECTION 28 46 00

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.
- C. Circuits from protected premises to supervising station, including conduit.
- D. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping: Materials and methods for work to be performed by this installer.
- B. Section 08 33 23 - Overhead Coiling Doors: Coiling fire doors to be released by fire alarm system.
- C. Section 08 71 00 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- D. Section 21 22 00 - Clean-Agent Fire-Extinguishing System: Supervisory, alarm, and releasing devices installed in extinguishing system.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
- D. NFPA 70 - National Electrical Code.
- E. NFPA 72 - National Fire Alarm and Signaling Code.
- F. NFPA 101 - Life Safety Code.
- G. NFPA 601 - Standard for Security Services in Fire Loss Prevention.

1.04 CONTRACTOR DESIGN

- A. The fire alarm system is Contractor designed and Contractor built.
- B. Equipment shown on the contract drawings indicates the general nature of the fire alarm system and provides coordination with the architectural design, but does not show all the components required for a complete system. Provide a complete fire alarm and communications system as needed to meet applicable codes and requirements under this section.
- C. Review various sets of drawings for initiating and notification devices, and add devices if needed to comply with the requirements of NFPA 72.
- D. Raceway, routing, and wiring for field devices are not shown on the drawings except for a few specific design requirements.

- E. The contractor-designed fire alarm system will be reviewed and approved by the authorities having jurisdiction.
- F. The contractor's shop drawing will be the design documents for the fire alarm system installation. Any changes required during construction shall be addressed and updated on the contractors shop drawings.
- G. The Contractor-designed shop drawings will be the record drawing set at the project completion. All changes implemented during construction shall be documented, updated, and submitted as the as-built record drawing set.

1.05 SUBMITTALS

- A. Proposal Documents: Submit the following with cost/time proposal:
 - 1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
 - 3. Certification by Contractor that the system design will comply with Contract Documents.
 - 4. Proposed maintenance contract.
- B. Drawings must be prepared using AutoCAD Release 2015 or newer.
 - 1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.
- C. Evidence of designer qualifications.
- D. 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. Fire command center control panels: smoke evacuation controls, pressurization and smoke damper controls, elevator capture, standby power status, fireman communications and voice evacuation. Provide panel layouts, fabrication and wiring details.
 - 10. Air-Sampling Smoke Detection Systems: Include air-sampling pipe network layout with sampling ports identified; include calculations demonstrating compliance with specified requirements.
 - 11. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 - 12. Detailed drawing of graphic annunciator(s).
 - 13. 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.
 - 14. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
 - 15. Certification by Contractor that the system design complies with Contract Documents.

- E. Evidence of installer qualifications.
- F. Evidence of instructor qualifications; training lesson plan outline.
- G. Evidence of maintenance contractor qualifications, if different from installer.
- H. 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.
- I. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
 - 1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
 - 2. Complete set of specified design documents, as approved by authority having jurisdiction.
 - 3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 - 4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 - 5. List of recommended spare parts, tools, and instruments for testing.
 - 6. Replacement parts list with current prices, and source of supply.
 - 7. Detailed troubleshooting guide and large scale input/output matrix.
 - 8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 - 9. 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.
- J. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
 - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- K. Closeout Documents:
 - 1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 - 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
 - 3. Certificate of Occupancy.
 - 4. Maintenance contract.
 - 5. Report on training results.
- L. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
 - 3. In addition to the items in quantities indicated in PART 2, furnish the following:

- a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
- b. One copy, on CD-ROM, of all software not resident in read-only-memory.
- c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

1.06 QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
- B. 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.
- C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
 4. Contract maintenance office located within 50 miles of project site.
 5. Certified in the State in which the Project is located as fire alarm installer.
- D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- 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 SEQUENCE OF OPERATION

- A. The system alarm operation subsequent to the alarm activation of manual station, automatic initiating device, or sprinkler flow/pressure switch is to be as follows:
 1. Audible alarm indicating appliances sound a digitized tone until silenced by the alarm silence switch at the control panel.
 2. Visual alarm indicating appliances (xenon strobes) display a continuous pattern until extinguished by the alarm silence switch.
 3. Doors normally held open by door control devices release. Signal door lock systems to unlock.
 4. A supervised signal notifies an approved central station to activate.
 5. Combination fire/smoke dampers de-energizes to normally closed position.
- B. Alarm activation of elevator lobby, hoistway, or machine room smoke or heat detector in addition to the operations listed above, cause the elevator cab to be recalled according to the following sequence:
 1. If the alarmed detector is on another floor other than the preferred level of egress, recall elevator cab to the preferred level of egress.

2. If the alarmed detector is on the main egress level, the elevator cabs recalled to the predetermined alternate recall level as determined by the local authority having jurisdiction.
 3. The activation of heat detector in an elevator hoistway or machine room automatically disconnect power to the elevator motor via base-mounted contacts activating the elevator feeder shunt-trip circuit breaker. Refer to drawings.
- C. Control panel has a dedicated supervisory service indicator and a dedicated supervisory service acknowledge switch.
- D. The activation of standpipe or sprinkler valve tamper switch activates the system supervisory service audible signal and illuminates the indicator at the control panel.
1. Activating the supervisory service acknowledge switch will silence the supervisory audible signal while maintaining the supervisory serviced LED on indicating the tamper contact is still in the off-normal state.
 2. Restoring the valve to the normal position cause the supervisory service indicator to extinguish thus indicating restoration to normal position.
- E. The activation of sprinkler pre-action system pressure or low air switch activate the system supervisory service audible signal and illuminate the indicator at the control panel.
1. Activating the supervisory service acknowledge switch will silence the supervisory audible signal while maintaining the supervisory service indicator on indicating the pressure/air contact is still in the off-normal state.
 2. Restoring the air pressure to the normal causes the supervisory service indicator to extinguish thus indicating restoration to normal position.
- F. Immediately display alarm and trouble conditions on the control panel front alphanumeric display and of remote annunciators. If more alarms or troubles are in the system the operator may scroll to display new alarms.
- G. Alarm list key that will allow the operator to display alarms, troubles, and supervisory service conditions with the time of occurrence.
- H. In normal operation, fire alarm system close combination fire/smoke dampers when corresponding fan system is OFF. Fire alarm system open combination fire/smoke dampers when corresponding fan system is ON.

1.08 WARRANTY

- A. See Section 01 78 00 - 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. Potter Electric Signal Company
 2. Honeywell Security & Fire Solutions/Gamewell-FCI
 3. Honeywell Security & Fire Solutions/Fire-Lite.
 4. Honeywell Security & Fire Solutions/Notifier.
 5. Honeywell Security & Fire Solutions/Silent Knight.
 6. Notifer
 7. Potter Electric Signal Company.
 8. Siemens Building Technologies, Inc.

9. Simplex, a Tyco Business.
 10. EST Edwards
 11. Provide control units made by the same manufacturer.
- B. Initiating Devices and Notification Appliances:
1. Same manufacturer as control units.
 2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.
- C. Substitutions: See Section 01 60 00 - 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 State Fire Marshal.
 - c. The requirements of the local authority having jurisdiction , which is the City of Beaverton.
 - d. Applicable local codes.
 - e. Contract Documents (drawings and specifications).
 - f. NFPA 101.
 - g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
 7. Staff Response Zones: For each smoke zone where occupants are not ambulatory, program notification zone as directed to notify staff in areas outside the normal notification zone and in other buildings, for response to assist in evacuation.
 8. Program notification zones and voice messages as directed by Owner.
 9. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
 10. Fire Command Center: Location indicated on drawings.
 11. Fire Alarm Control Unit: New, located at fire command center.
 12. Two-Way Telephone: Provide two-way telephone service for the use of the fire service and others; provide jacks and two portable handsets.
 13. Guard's Tour: Provide guard's tour supervisory service in accordance with NFPA 601.
 14. Combined Systems: Do not combine fire alarm system with other non-fire systems.
- B. Fire Department Connections:

1. Public Fire Department Notification: By on-premises supervising station.
 2. Auxiliary Connection Type: Local energy.
- 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. Signaling Line Circuits (SLC) Between Buildings: Class A, Style 2.
 4. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 3. Speaker Amplifiers: Minimum 25 percent spare capacity.
 4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
 2. Secondary: Storage batteries.
 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water storage tank low level.
 2. Sprinkler water storage tank low temperature.
 3. Fire pump(s).
 4. Elevator shut-down control circuits.
 5. Chute interlocks and controls.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Total flooding suppression system activation.
 2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
 3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
 4. Duct smoke detectors.
- C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
 2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
 3. Elevator capture and control.
- D. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 71 00.
 2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 71 00.
 3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 33 23.
 4. Generators and ATS systems.
 5. Standby system status.

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.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
 - 1. Printer:
- D. Remote Annunciators: .
- E. 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. Provide 1 extra.
 - 3. Key Operated Pull Stations:
 - a. Provide 1 extra.
 - 4. Smoke Detectors:
 - a. Provide 1 extra.
 - 5. Duct Smoke Detectors: .
 - a. Provide 1 extra.
 - 6. Heat Detectors: .
 - a. Provide 1 extra.
 - 7. Addressable Interface Devices: .
 - a. Provide 1 extra.
 - 8. Projected Beam Type Smoke Detector.
- F. Notification Appliances:
 - 1. Bells: .
 - a. Provide 1 extra.
 - 2. Speakers: .
 - a. Provide 1 extra.
 - 3. Combination Horn/Strobes: .
 - a. Provide 1 extra.
- G. Electromagnetic Door Holders.
- H. Electronic Water Flow Bell.
- I. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
- J. 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. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
 3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.
- K. 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
- L. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 2. Provide one for each control unit where operations are to be performed.
 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 4. Provide extra copy with operation and maintenance data submittal.
- M. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
1. Padlock eye and hasp for lock furnished by Owner.
 2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.
- E. All components and devices shall be installed in an accessible and maintainable location.

3.02 LABELING

- A. Label alarm initiating devices with 1/2-inch by 1-inch lamicaid nameplates, indicating control panel point designation. Locate nameplates in the vicinity of the device as approved by the Owner.
- B. Provide Brady type wire markers to identify conductors at each junction or terminal. Use numbers indicated on the wiring diagrams.

3.03 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Owner will provide the services of an independent fire alarm engineer or technician to observe all tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

- F. Provide all tools, software, and supplies required to accomplish inspection and testing.
- G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- H. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
 - 1. Record all system operations and malfunctions.
 - 2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 - 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
 - 4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.04 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
 - 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
 - 3. Factory Instruction: At control unit manufacturer's training facility.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
 - 1. Initial Training: 1 session pre-closeout.
 - 2. Refresher Training: 1 session post-occupancy.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: 1 session pre-closeout.
 - 2. Refresher Training: 1 session post-occupancy.
- D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
 - 1. Initial Training: 1 session pre-closeout.
 - 2. Refresher Training: 1 session post-occupancy.
- E. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
 - 1. Initial Training: One 3-day session, pre-closeout.
 - 2. Refresher Training: One 1-day session post-occupancy.
- F. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.
- G. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

3.05 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.

4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 5. Repeat demonstration until successful.
- B. Occupancy of the project will not occur prior to Substantial Completion.
- C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
1. Specified diagnostic period without malfunction has been completed.
 2. Approved operating and maintenance data has been delivered.
 3. Spare parts, extra materials, and tools have been delivered.
 4. All aspects of operation have been demonstrated to Owner.
 5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
 6. Occupancy permit has been granted.
 7. Specified pre-closeout instruction is complete.
- D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.06 EXTRA STOCK/SPARE PARTS

- A. Provide the following equipment to be turned over to the Owner with the operation and maintenance manuals.
1. Two photoelectric smoke detector heads.
 2. Two thermal heat detector heads.
 3. One addressable dry contact modules.
 4. Two horns.
 5. Two horns/strobes.
 6. One manual pull station.
 7. One complete set of fuses to match panel counts.

END OF SECTION

SECTION 31 10 00**SITE CLEARING****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Removal of existing trees and vegetation
- B. Clearing vegetation, debris, trash and other materials within limits indicated
- C. Grubbing of vegetation within limits indicated
- D. Stripping of topsoil within limits indicated
- E. Removing above-grade site improvements within limits indicated
- F. Disconnecting, capping or sealing, and abandoning site utilities in place
- G. Disconnecting, capping or sealing, and removing site utilities
- H. Disposing of objectionable material

1.2 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 12 16, Asphalt Paving
- C. Section 32 13 13, Concrete Pavement

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Report of Geotechnical Engineering Services – Elmonica, by NV5, January 12, 2022.
- B. ANSI A300: Industry Standards for Tree Care Practices
- C. Applicable Publications
 - 1. "Trees and Building Sites," official publication of the International Society of Arboriculture.
 - 2. "Arboriculture," the care of trees and shrubs by Dr. Richard Harris.

1.4 DEFINITIONS

- A. ANSI: American National Standards Institute
- B. Oregon OSHA: Oregon Occupational Safety and Health Administration

- C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.5 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 QUALITY ASSURANCE

- A. Do not remove or prune trees without first securing a permit from the appropriate agency.
- B. Prune to the standards of the International Society of Arborists and to ANSI A300.

1.7 PROJECT CONDITIONS

- A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Owner's Representative. Avoid damaging materials designated for salvage.
- C. Unidentified Materials;
 - 1. If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the Owner's Representative.
 - 2. If necessary, the Owner's Representative will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to engineered fill defined in Section 31 20 00, Earth Moving.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Protect and maintain benchmarks and survey control points during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain during construction.

3.2 TREE REMOVAL

- A. Remove trees designated for removal prior to the construction of new improvements in the vicinity:
 - 1. When demolishing trees indicated to be removed within areas for new pavement or hardscape, remove tree, stump to a depth of two (2) feet below finish grade, and all roots located in the top twelve (12) inches of soil. Remove wood chips created from grinding process down to remaining stump then refill void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Import soil and compaction in future paved areas shall be in accordance with Section 32 12 16, Asphalt Paving and Section 32 13 13, Concrete Pavement.
 - 2. When demolishing trees indicated to be removed within new landscaped areas, removal shall be done in one of the following ways:
 - a. For trees located in accessible areas, remove tree and grind stump to four (4) inches below finish grade. Backfill the void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Do not remove existing roots.
 - b. For trees located in inaccessible areas, cut stump flush with finish grade, and cover with 3 inches of bark mulch. Do not grind the stump and do not remove existing roots.
- B. Perform tree removal work in a safe and proper manner, adhering to Oregon OSHA tree work protection standards and ANSI A300 Standards.
- C. All trees to be demolished shall be removed in such a way as to not damage branches, trunks, or root systems of adjacent trees.

3.3 RESTORATION

- A. Restore damaged improvements to their original condition, as acceptable to the Owner's Representative.
- B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, as directed by the Owner's Representative.

1. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the Owner's Representative.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.
- B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner's Representative or others unless authorized in writing by the Owner's representative, and then only after arranging to provide temporary utility services according to requirements indicated.
- D. Coordinate utility interruptions with utility company affected.
- E. Do not proceed with utility interruptions without the permission of the Owner's Representative and utility company affected. Notify Owner's Representative and utility company affected two working days prior to utility interruptions.
- F. Excavate and remove underground utilities that are indicated to be removed.
- G. Fill abandoned piping with cement slurry.
- H. Securely close ends of abandoned piping with tight fitting plug or cement slurry minimum 6 inches thick.

3.5 CLEARING AND GRUBBING

- A. Areas to be graded shall be cleared of existing vegetation, rubbish, existing structures, and debris.
- B. Remove obstructions, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
- C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
- D. Use only hand methods for grubbing within drip line of remaining trees.

3.6 SITE STRIPPING

- A. Strippings and spoils shall be disposed at an off-site location, per geotechnical recommendations and local regulations.
- B. Remove vegetation before stripping soil.
- C. Surface soils that contain organic matter should be stripped. In general, the depth of required stripping will be relatively shallow (i.e. less than 2 inches); deeper stripping and grubbing may be required to remove isolated concentrations of organic matter or roots.
- D. Remove trash, debris, weeds, roots, and other waste materials.
- E. Stockpile soil materials designated to remain on site at a location approved by the Owner's Representative at a location away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- F. Do not stockpile soil within drip line of remaining trees.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.8 BACKFILL

- A. Place and compact material in excavations and depressions remaining after site clearing in accordance with Section 31 20 00, Earth Moving.

3.9 DISPOSAL

- A. Remove surplus soil material, unsuitable soil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

END OF SECTION

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SECTION 31 20 00**EARTH MOVING****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, building pads, walks, paths, or trails and any other site improvements called for on the Plans.

1.2 SECTION EXCLUDES

- A. Earthwork related to underground utility installation shall be performed in accordance with Sections 31 21 00, Utility Trenching and Backfill.

1.3 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 01 50 50, Erosion Control
- C. Section 31 10 00, Site Clearing
- D. Section 31 23 19, Dewatering
- E. Section 33 46 00, Subdrainage

1.4 RELATED DOCUMENTS

- A. Geotechnical Report: Report of Geotechnical Engineering Services – Elmonica, by NV5, January 12, 2022.
- B. ASTM
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D1586, Method for Penetration Tests and Split-Barrel Sampling of Soils
 - 3. D2487, Classification of Soils for Engineering Purposes
 - 4. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 5. D4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 6. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 7. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- C. Oregon Standard Specifications for Construction, section 00330.
- D. ODOT Standard Specifications, (current edition).

- E. OSHA, Title 8.

1.5 DEFINITIONS

- A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.
- B. Excavation: Removal of material encountered above subgrade elevations.
1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by the Geotechnical Engineer.
 2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.
- C. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- D. Structural Backfill: Soil materials approved by the Geotechnical Engineer and used to fill excavations resulting from removal of existing below grade facilities, including trees.
- E. Structural Fill: Soil materials approved by the Geotechnical Engineer and used to raise existing grades.
- F. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.
- I. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.
- J. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. The Geotechnical Engineer will determine if a soil material is unsuitable.

- K. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.
- L. Utilities: onsite underground pipes, conduits, ducts and cables.
- M. Wet Weather Conditions: Wet Weather Conditions apply to materials placed during dry weather but which are subsequently subjected to rainfall and equipment or construction traffic. The Contractor shall be responsible for the performance of the selected type of material.

1.6 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Samples:
 - 1. If required by the Geotechnical Engineer, provide 20 pound samples, sealed in airtight containers, tagged with source locations and suppliers of each proposed soil material from on-site or borrow sources, 72 hours prior to use. Do not import materials to the Project without written approval of the Geotechnical Engineer.
 - 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer.
- C. Material Test Reports: If Geotechnical Engineer is not on-site during construction, provide, from a qualified testing agency, the test results showing compliance with the project requirements.
- D. Classification according to ASTM D2487 of each onsite or borrow soil material proposed for fill and backfill.
 - 1. Laboratory compaction curve in conformance with ASTM D1557 for each onsite or borrow soil material proposed for fill and backfill.

1.7 QUALITY ASSURANCE

- A. If Geotechnical Engineer is not on-site during construction, provide an independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- B. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- C. Conform all work in accordance with Oregon Standard Specifications for Construction Section 00330, Earthwork.

- D. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.
- E. Perform excavation, filling, compaction and related earthwork under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the Owner. Notify the Geotechnical Engineer at least 24 hours prior to commencement of earthwork and at least 48 hours prior to testing. *[Verify hours.]*
- F. The Geotechnical Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.
- G. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications and the Geotechnical Report. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of the Geotechnical Engineer have been displaced or are otherwise unsatisfactory due to the Contractor's operations.
- H. Finish subgrade tolerance at completion of grading:
 - 1. Building and paved areas: ± 0.05 feet
 - 2. Other areas: ± 0.10 feet

1.8 PROJECT CONDITIONS

- A. Promptly notify the Owner's Representative of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner's Representative verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless the Contractor has notified the Owner's Representative in writing of differing conditions prior to the Contractor starting work on affected items.
- B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Prevent erosion of freshly-graded areas during construction and until such time as permanent drainage and erosion control measures have been installed in accordance with Section 01 50 50, Erosion Control.
- D. Temporarily stock-pile fill material in an orderly and safe manner and in a location approved by the Owner's Representative.

- E. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Native Materials: Excavated on-site soil, native to the project site, free of organics, solids larger than 3 inch diameter, weeds and other deleterious matter as approved by the Geotechnical Engineer for use as fill [only during dry weather conditions].
- B. Imported fill soils, if required, should be predominantly granular in nature, and should be free of organics, debris, or rocks over 3 inches in size, and shall be approved by the Geotechnical Engineer before importing to the site. Imported non-expansive soils shall have a Plasticity Index less than 15 as determined by ASTM D4318, an R-value of at least 20, and fines content between 15 and 65 percent.

2.2 SOIL STERILANT

- A. Monobor Chlorate soil sterilant, liquid and/or granular form.

2.3 CRUSHED ROCK FILL AND PAVEMENT BASE

- A. Imported clean 3/4" -0 or 1-1/2" - 0 crushed rock or crushed gravel, free from foreign material and conforming to the requirements of ODOT Standard Specification (latest revision) 02630.

2.4 EROSION BLANKET

- A. Erosion blanket to be Type 2, straw and coconut. Furnish blanket consisting of undyed, untreated, biodegradable, jute, coconut coir, synthetic polypropylene fibers, or approved yarn woven into a plain weave mesh with 5/8- to 1-inch square openings. Ensure material conforms to the following:

<u>Material</u>	<u>Specification Minimums</u>
Straw 70% *	
Coconut 30%	Straw and Coconut mass to be 0.5 lb/sy (0.25" minimum thickness) Netting Photodegradable netting on bottom side. 5/8 to 1-inch square mesh** with a 0.3 oz/sy weight.

* Moisture content shall not exceed 20%.

** Dimensions are approximate and may vary to meet manufacturer's standards.

Contech's 70% straw / 30% coconut meets these requirements.

PART 3 - EXECUTION**3.1 GENERAL**

- A. Contractor shall perform all excavation necessary or required for proper construction of the work and placement or installation of materials.
- B. Cutting Pavements: Cut vertical, straight-line joints using power saw designed for cutting pavements.
- C. Line and Grade: Excavate to lines and grades shown on the drawings or as established by the Engineer.
- D. Shoring: Shore excavations when necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public or as required by local, state, or federal agencies. Shoring shall be removed, as the backfilling is done, in a manner that does not damage work or permit voids in the backfill. It shall be the sole responsibility of the Contractor to see that safety requirements are met.
- E. Temporary stockpiling of Excavated Materials: Excavated materials may be placed in approved areas. Do not obstruct roadways, bikeways, or pedestrian walkways. Conform to all federal, state and local codes governing the safe loading of excavated materials adjacent to excavations.
- F. Drainage: Except as otherwise permitted, excavation shall be done in a manner as to provide for adequate drainage. In excavation where gravity drainage is not practical, the Contractor shall provide pumps and accessories with which to remove and dispose of all water, including but not limited to, surface water from rainfall entering the excavations, as required to accomplish the work and as required by governing jurisdictions.
- G. Backfilling shall not commence until after excavations have been inspected. Backfill shall be placed in such a manner as not to disturb, damage, or subject such facilities to unbalanced loads or forces. Make fills as soon as feasible after Engineer's review and acceptance.
- H. If rock or unstable soil are encountered, notify Engineer. Removal of rock or unstable soil will be paid for as an addition to the contract.
- I. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- J. The use of explosives will not be permitted.
- K. Grading and earthwork operations shall be observed and tested by a representative of the Geotechnical Engineer for conformance with the project plans/specifications and the geotechnical recommendations. This work includes site preparation, selection of satisfactory materials, and placement and compaction of the subgrades and fills.

Sufficient notification prior to commencement of earthwork is essential to make certain that the work will be properly observed.

3.2 GEOTEXTILE PLACEMENT

- A. Acquisition and Storage: Provide complete rolls of geotextile as furnished by the manufacturer, and protect against damage and deterioration. Store all geotextile rolls in a dry place and off the ground at all times according to ASTM D4873 (latest revision). Cover all rolls and partial rolls with a dark protective covering when received. The geotextile will be rejected for use if the Engineer determines it has defects, deterioration, or has been damaged.
- B. Surface Preparation: Prepare the surface receiving the geotextile to a smooth condition free of obstructions, depressions, and debris unless otherwise directed. Do not drag the geotextile on the ground or mishandle it in any way.
- C. Loosely place the geotextile without wrinkles so placement of the overlying material will not tear the geotextile. Lap or sew the geotextile at the ends and sides of adjoining sheets as specified.
- D. On Slopes: Place the geotextile with the machine direction oriented up-down the slope. Lap the upper sheets over the top of the lower sheets. When the geotextile is placed on a slope steeper than 6:1, securely anchor the laps to the ground surface with pins or stakes as necessary to prevent slippage and tearing of the geotextile. Start placement of fill material on the geotextile at the toe of the slope and proceed upwards.
- E. Overlap: Minimum overlap shall be 24 inches.
- F. If the Engineer determines the specified overlap is not sufficient, increase the overlap to provide adequate coverage or sew the geotextile together in the field. If field-sewn, the provisions of ODOT 00350.20 and 00350.41(a-3) apply.
- G. Protection of Geotextile: Protect the geotextile at all times from ultraviolet (UV) rays, contamination by surface runoff, and construction activities.
- H. Traffic or construction equipment will not be permitted directly on the geotextile except as authorized by the Engineer. When placed for construction, cover the geotextile with specified cover material as soon as possible.
- I. Place cover material on the geotextile in a manner that the geotextile is not torn, punctured, or shifted. Use a minimum 6-inch-thick cover layer or twice the maximum aggregate size, whichever is thicker. End-dumping cover material directly on the geotextile will not be permitted.
- J. Limit construction vehicles in size and weight so rutting in the initial layer above the geotextile is not more than three inches deep or one half the layer thickness, whichever is less. Turning of vehicles on the first layer will not be permitted.

- K. Repair of Geotextile: Repair or replace all torn, punctured, or contaminated geotextiles during construction at no cost to the Owner. Repair by placing a patch of the specified geotextile over the affected area. Where geotextile seams are required to be sewn, repair any damaged sheet by sewing unless otherwise indicated on the plans or special provisions or as directed

3.3 CONTROL OF WATER AND DEWATERING

- A. Comply with Section 31 23 19, Dewatering, if dewatering is necessary.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.
- C. Dewater during backfilling operation so that groundwater is maintained a least 1 foot below level of compaction effort.
- D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.
- E. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- F. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.
- G. Maintain dewatering system in place until dewatering is no longer required.

3.4 WET WEATHER CONDITIONS

- A. Do not prepare subgrade, place or compact soil materials if subgrade or materials are above optimum moisture content.
- B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.5 BRACING AND SHORING

- A. Conform to Oregon and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Geotechnical Engineer, the

Consulting Engineer for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in Oregon. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.

- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.6 TOPSOIL STRIPPING

- A. Remove topsoil in accordance with Section 31 10 00, Site Clearing.

3.7 EXCAVATION

- A. Excavate earth and rock to lines and grades shown on plans and to the neat dimensions indicated on the plans, required herein or as required to satisfactorily compact backfill.
- B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- C. Excavation through buried concrete and other unknown obstructions will require specialized techniques for demolition and removal.
- D. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- E. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.8 GRADING

- A. Uniformly grade the Project to the elevations shown on plans
- B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.
- C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.9 SUBGRADE PREPARATION

- A. Subgrade Preparation: Prior to backfilling depressions created by the removal of old foundations and utility lines, scarify the bottom of the excavation to an approximate depth of 8 inches and uniformly moisture condition the scarified surfaces to a moisture content that is at least 2 percent over optimum. Compact the scarified

surfaces to a minimum of 90 percent relative compaction at above optimum moisture content.

- B. Over-excavate any remaining soft (pumping) areas down to firm soil and backfill the area.
- C. Subgrade shall be maintained in a moist, but not wet, condition by periodically sprinkling water prior to the placement of additional fill or installation of roads. Subgrade that has been permitted to dry out and loosen or develop desiccation cracking should be scarified, moisture conditioned, and re-compacted as recommended above.
- D. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.
- E. Prepare subgrades under the structural section of paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.
- F. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.
- G. Obtain the Geotechnical Engineer's approval of subgrades prior to placing pavement structural section.

3.10 EROSION BLANKET PLACEMENT

- A. Erosion blanket is to be installed per manufacturer's specifications. Assure blanket overlap and staple frequency meet manufacturer's application guidelines. Apply seed to cut slope prior to blanket installation.

3.11 KEYWAYS AND BENCHES

- A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway 5 feet minimum into competent, undisturbed soil or 3 feet minimum into competent, undisturbed rock as directed by the Geotechnical Engineer.
- B. Place subsurface drains in bottom of keyway in accordance with Section 33 46 00, Subdrainage.
- C. Bench subgrade as indicated above toe of fill.
- D. Place subsurface drains at benches every 20 vertical feet or as directed by the Geotechnical Engineer.

3.12 LOT FINISH GRADING

- A. Blade finish lots to lines and grades indicated.

3.13 FILL PLACEMENT AND COMPACTION

- A. Place fill in uniformly moisture conditioned and compacted lifts not exceeding 8 inches in loose thickness. Each lift should be thoroughly moisture conditioned and compacted to 90 percent before successive fill layers are placed.
- B. In order to achieve satisfactory compaction in the subgrade and fill soils, it may be necessary to adjust the soil moisture content at the time of soil compaction per geotechnical recommendations. This may require that water be added and thoroughly mixed into any soils which are too dry or that scarification and aeration be performed in any soils which are too wet.
- C. Obtain the Geotechnical Engineer's approval of surface to receive structural fill prior to placement of structural fill material.
- D. Place structural fill on prepared subgrade.
- E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.
- F. Do not compact by ponding, flooding or jetting.
- G. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by the Geotechnical Engineer.
- H. Compaction requirements (unless specified otherwise by the Geotechnical Engineer):
 - 1. Compact structural fills less than 5 feet thick to 90 percent compaction.
 - 2. Compact structural fill 5 feet thick or greater to 95 percent compaction.
 - 3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5 feet beyond pavement edges unless specified otherwise by the Geotechnical Engineer.
 - 4. Compact the upper 6 inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.

3.14 BIO-RETENTION SOIL

- A. Install as shown on the Drawings.
- B. Compact to 80% relative compaction per ASTM D1557.

3.15 SOIL STERILIZATION

- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also, where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.

- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

3.16 SEEDING

- A. Plant only at times when local weather and other conditions are favorable to the preparation of soil, germination, and growth. Areas shall be sown evenly with a spreader at a rate of one pound per 150 square feet, rolled, covered to 1/4 inch with approved mulch, and watered to establish a smooth, uniformly grassed area.

3.17 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 31 21 00**UTILITY TRENCHING AND BACKFILL****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping, underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc., and associated structures.
- B. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:
 - 1. Select Backfill Material
 - 2. Aggregate Base
 - 3. Detectable Tape
 - 4. Trench Excavation
 - 5. Pipe Bedding
 - 6. Trench Backfill
 - 7. Trench Surfacing
- C. This section excludes drainage fill material and placement around subdrains. See Section 33 46 00 – Subdrainage.

1.2 RELATED SECTIONS

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earthwork Moving
- C. Section 31 23 19 - Dewatering
- D. Section 33 10 00 – Water System
- E. Section 33 30 00 – Sanitary Sewer System
- F. Section 33 41 00 – Storm Utility Drainage Piping
- G. Section 33 46 00 – Subdrainage

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Report of Geotechnical Engineering Services – Elmonica, by NV5, January 12, 2022.
- B. ASTM

1. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 2. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications.
- C. ODOT Standard Specifications, (current edition).

1.4 DEFINITIONS

- A. AC: Asphalt Concrete
- B. ASTM: American Society for Testing and Materials
- C. Base: The layer placed between the subgrade and surface pavement in a paving system.
- D. Bedding: Material from bottom of trench to bottom of pipe
- E. CDF: Controlled Density Fill
- F. DIP: Ductile Iron Pipe
- G. Engineered Fill:
1. Soil or soil-rock material approved by the Owner and transported to the site by the Contractor in order to raise grades or to backfill excavations.
 2. Contractor shall provide sufficient tests, and a written statement that all materials brought onto the project site comply with specification requirements.
- H. Excavation: Consists of the removal of material encountered to subgrade elevations
- I. Initial Backfill: Material from bottom of pipe to 12 inches above top of pipe
- J. PCC: Portland Cement Concrete
- K. RCP: Reinforced Concrete Pipe
- L. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.
- M. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of $\frac{1}{2}$ the outside diameter measured from the top or bottom of the pipe.
- N. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.
- O. Subsequent Backfill: Material from 12 inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.

- P. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by the Geotechnical Engineer.
 2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.
- Q. Utility Structures:
1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
 2. Sanitary sewer manholes, vaults, etc.
 3. Water vaults, etc.

1.5 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 10 00 – Supplemental General Requirements.
- B. Test Reports: Submit the following report for import material directly to the Owner from the Contractor's testing services:
1. Compaction test reports for aggregate base.
- C. Samples:
1. If required by the Geotechnical Engineer, provide 20-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material. Do not import materials to Project without written approval of the Geotechnical Engineer and the Owner.
 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer and the Owner.

1.6 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Conform all work to the appropriate portion(s) of the ODOT Standard Specifications, Section 00330, Earthwork.
- C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
[Use either Article D or E depending on whether the Owner or the Contractor will be performing the soil testing.]
- D. The Geotechnical Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the trench backfill. Correct the trench backfill

that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.

- E. Soil Testing:
 - 1. Contractor to engage a geotechnical testing agency, to include compaction testing and for quality control testing during fill operations.
 - 2. Test results will be submitted to the Owner.

1.7 PROJECT CONDITIONS

- A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.
- B. Barricade open excavations and post with warning lights.
 - 1. Operate warning lights and barricades as required.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.
 - 3. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.
- D. Provide dust and noise control in conformance with Section 01 10 00 Supplemental General Requirements.
- E. Environmental Requirements:
 - 1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
 - 2. Protect existing streams, ditches and storm drain inlets during work on this project.
- F. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.
- G. Transport all excess soils materials by legally approved methods to disposal areas.
 - 1. Coordinate with the Engineer.
 - 2. Any additional fill requirements shall be the responsibility of the Contractor.

1.8 EXISTING UTILITIES

- A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.

1. Locating of existing underground utilities shall include but not be limited to pot-holing prior to the start of construction.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Owner and/or utility agency immediately for directions.
 1. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation.
 2. Repair damaged utilities to the satisfaction of the agency with jurisdiction.
- C. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Import materials will be subject to approval of the Geotechnical Engineer.
- B. For approval of imported fill material, notify the Owner at least 7 days in advance of intention to import material.

2.2 PIPE BEDDING AND INITIAL BACKFILL

- A. Imported, clean, 3/4" - 0 crushed rock or crushed gravel, free from foreign material and meeting the requirements of ODOT Standard Specifications (current edition) 02630.
- B. Sand: Imported blend sand shall consist of sand and river rock naturally produced by the disintegration of rock or produced from crushed gravel. Shall be free of organic material, mica, clay, and other deleterious substances and approved by the Engineer and Geotechnical Engineer prior to delivery to site. Thirty percent of the material shall be within the 1/4 inch to 3/4 inch size. No more than 5 percent passing the No. 200 sieve

2.3 SELECT BACKFILL

- A. Select backfill material shall be gravel, free of clay or organic matter and shall conform to the following gradation:

Sieve Size	Percentage Passing
1 inch	100
¾ inch	90 – 100
No. 4	35 – 60
No. 200	2 - 9

- B. For gas pipe and fuel piping select backfill shall be clean, graded building sand conforming to the following gradation:

Sieve Size	Percentage Passing
No. 4	100
No. 200	0 -5

2.4 WARNING TAPE

- A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
1. Warning Tape Color Codes
 - a. Red: Electric
 - b. Yellow: Gas, Oil; Dangerous Materials
 - c. Orange: Telephone and Other Communications
 - d. Blue: Water Systems
 - e. Green: Sewer Systems
 - f. White: Steam Systems
 - g. Gray: Compressed Air
 2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
 3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.5 DETECTION WIRE FOR NON-METALLIC PIPING

- A. Detection wire shall be insulated single strand, solid copper with a minimum of 18 AWG.

2.6 SUBSEQUENT BACKFILL

- A. Conform to on-site or imported structural backfill in Section 31 20 00, Earth Moving.

2.7 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

- A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive

28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8 inch top size. The 3/8 inch aggregate shall not comprise more than 30% of the total aggregate content.

- B. Cement: Conform to the standards as set forth in ASTM C150, Type II Cement.
- C. Fly Ash: Conform to the standards as set forth in ASTM C618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.
- D. Air Entraining Agent: Conform to the standards as set forth in ASTM C260.
- E. Aggregates need not meet the standards as set forth in ASTM C33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
- F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.
- G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.
- H. Mix design shall meet the Geotechnical Engineer's approval.

2.8 CONCRETE STRUCTURE BEDDING AND BACKFILL

- A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by the Geotechnical Engineer.
- B. Poured-in-Place Structures:
 - 1. Bedding: Bedding shall meet the approval of the Geotechnical Engineer. In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
 - 2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 20 00, Earth Moving.

2.9 GEOSYNTHETICS

- A. Drainage Geotextile
 - 1. Non-woven geotextile; grab tensile strength 90 lb minimum per ASTM D4632 each direction; burst strength 185 psi minimum per ASTM D3786; puncture strength 55 lb minimum per ASTM D4833 or ASTM D3787 OSHD TM 816; No. 70 sieve or smaller opening per ASTM D4751; minimum 150 gal/min/ft².

2. Amoco 4545 or approved equal.
- B. Drainfield Filter Fabric
1. Filter fabric shall meet the following specifications:
 - a) Material synthetic fabric: Either spun-bonded or woven.
 - b) Burst Strength, psi: Not less than 25 psi.
 - c) Air Permeability, cfm per sq.ft.: Not less than 500.
 - d) Water Flow Rate: Not less than 500 gpm per sq.ft. at 3 inches of head.
 - e) Surface Reaction to Water: Hydrophilic.
 - f) Equivalent Opening Size: 70 to 100 sieve.
 - g) Chemical Properties:
 - I. Non-biodegradable
 - II. Resistant to acids and alkalis within a pH range of 4 to 10
 - III. Resistant to common solvents

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the recommendations of the Geotechnical Engineer.
- B. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.
- C. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.
- D. Unless otherwise indicated in the Plans, all excavation for pipelines shall be open cut.
- E. Prior to commencement of work, become thoroughly familiar with site conditions.
- F. In the event discrepancies are found, immediately notify the Owner in writing, indicating the nature and extent of differing conditions.
- G. Backfill excavations as promptly as work permits.
- H. Do not place engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the Owner.
- I. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
- J. In excavations, use satisfactory excavated or borrow material.
- K. Under grassed areas, use satisfactory excavated or borrow material.

3.2 SITE PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.

3.3 EXISTING UTILITIES

- A. Identify the location of existing utilities.
 - 1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Plans, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.
 - 2. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 for assistance in locating existing utilities.
 - 3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Owner to clear the utility.
- B. Protect all existing utilities to remain in operation.
- C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor's risk.
- D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
 - 1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
 - 2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
 - 3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
 - 4. Report damage of utility line or subsurface structures immediately to the Owner.
- E. Backfill trenches resulting from utility removal in lifts of 8 inches maximum.

3.4 TRENCH EXCAVATION

- A. General
 - 1. Excavation shall include removal of all water and materials that interfere with construction. ~~—~~The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.

2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
 3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.
 4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.
- B. Existing Paving and Concrete:**
1. Existing pavement over trench shall be sawcut, removed, and hauled away from the job. Existing pavement shall be neatly sawcut along the limits of excavations.
 2. Existing concrete over the trench shall be sawcut to a full depth in straight lines, at a minimum distance of 12 inches beyond the edge of the trench, either parallel to the curb or a right angles to the alignment of the sidewalk.
 3. Boards or other suitable material shall be placed under equipment outrigging to prevent damage to paved surfaces.
- C. Trench Width:**
1. The maximum allowable trench widths at the top of the all pipe materials outside diameter of barrel pipe plus 18 inches. shall be as follows:
 - a. The maximum trench width shall be inclusive of all shoring.
 - b. If the maximum trench width is exceeded, the State's representative may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.
 2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.
- D. Excavation Width at Springline of Pipe:**
1. Up to a nominal pipe diameter of 24 inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by the Geotechnical Engineer.
 2. Nominal pipe diameter of 30 inches through 36 inches: Minimum of the outside pipe diameter plus 2 feet, or as otherwise allowed or required by the Geotechnical Engineer.
 3. Nominal pipe diameter of 42 inches through 60 inches: Minimum of the outside pipe diameter plus 3 feet, or as otherwise allowed or required by the Geotechnical Engineer.
- E. Open Trench:**
1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.
 2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.
 3. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and

- equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
4. Excavation Depth for Bedding: Minimum of 6 inches below bottom of pipe or as otherwise allowed or required by the Geotechnical Engineer, except that bedding is not required for nominal pipe diameters of 2 inches or less.
 5. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
 6. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
 7. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.
- F. Excavated Material:
1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.
 2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.
 3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

3.5 CONTROL OF WATER AND DEWATERING

- A. Contractor attention is directed to Section 31 23 19, Dewatering.
- B. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Geotechnical Engineer and the Owner until backfilling is completed.
- C. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.
- E. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.
- F. Maintain dewatering system in place until dewatering is no longer required.

3.6 BRACING AND SHORING

- A. Conform to Oregon and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent

damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

- C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Geotechnical Engineer, the Consulting Engineer for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in Oregon. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.7 PIPE BEDDING

- A. Obtain approval of bedding material from the Geotechnical Engineer.
- B. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of bedding material will not be permitted.
- C. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed rock. The State's inspector will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.
- D. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing select backfill material. Sufficient select backfill material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

3.8 BACKFILLING

- A. Initial Backfill:
 - 1. Obtain approval of backfill material from Geotechnical Engineer.
 - 2. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12 inches above the top of the pipe in layers not exceeding 8 inches in loose thickness. Compact

bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of initial backfill material will not be permitted.

- B. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.
- C. Installation of Tracer Wire:
1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
 3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
 4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.
- D. Installation of Warning Tape
1. Install tape approximately 1 foot above and along the centerline of the pipe.
 2. Where tape is not continuous lap tape ends a minimum of 2 feet.
- E. Subsequent Backfill:
1. Above the level of initial backfill, the trench shall be backfilled with non-expansive native material from trench excavation or with imported select backfill material (Contractor's option). Subsequent backfill shall be free of vegetable matter, stones or lumps exceeding 3 inches in greatest dimension, and other unsatisfactory material.
 2. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, except that the upper 36 inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of subsequent backfill material will not be permitted.
- F. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe. Jetting of trench backfill is not permitted.

- G. Utility backfill shall be inspected and tested by the Geotechnical Engineer during placement. Cooperate with the Geotechnical Engineer and provide working space for such tests in operations. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Geotechnical Engineer and the Owner prior to proceeding with the Project.
- H. Compaction testing shall be in accordance with ASTM test D1556 or D1557.

3.9 CLEANUP

- A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

END OF SECTION

SECTION 31 23 19**DEWATERING****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. The Contractor shall provide all labor, materials, and equipment necessary to dewater trench and structure excavations, in accordance with the requirements of the Contract Documents. The Contractor shall secure all necessary permits to complete the requirements of this section. The Contractor shall refer to Section 01 57 23, Storm Water Pollution Control, 31 20 00, Earth Moving, and 31 21 00, Utility Trenching and Backfill for other dewatering requirements.

1.2 RELATED SECTIONS

- A. Section 01 57 23, Storm Water Pollution Control
- B. Section 31 20 00, Earth Moving
- C. Section 31 20 00, Utility Trenching and Backfill

1.3 CONTRACTOR SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Prior to commencement of excavation, the Contractor shall submit a detailed plan and operation schedule for dewatering of excavations. The Contractor may be required to demonstrate the system proposed and to verify that adequate equipment, personnel and materials are provided to dewater the excavations at all locations and times. The Contractor's dewatering plan is subject to review by the Owner's Representative.

1.4 QUALITY CONTROL

- A. It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.
- B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.
- C. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals (at least weekly) to detect any settlement which may develop. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely on the Contractor. The cost of repairing any

damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

- D. It is the Contractor's responsibility to obtain all necessary local, state, and federal permits, permissions, and approvals for the selected discharge location.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pump equipment shall be maintained on the jobsite.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The Contractor shall provide all equipment necessary for dewatering. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all time, competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level. Dewatering shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this section or other requirements.
- C. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.
- D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
- E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock at no cost to the Owner. Drain rock layer shall be approved Class II Permeable Material.
- F. The Contractor shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation, construction, backfilling, and up to acceptance.

- G. Flotation shall be prevented by the Contractor by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.
- H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sand packed and/or other means shall be used to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. If well points or wells are used, a permit from the governing jurisdiction shall be obtained by the Contractor. Wells, well points and piezometers shall be installed and removed or abandoned in accordance with County requirements.
- I. Dewatering wells, well points, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least two feet below the bottom of excavations before the excavation work begins at each location. Water shall be removed and excluded until backfilling is complete and all field soils testing have been completed.
- J. Dewatering Design Criteria: The Contractor shall design its dewatering systems to meet the following minimum requirements:
1. Provide stable excavation walls and bottom in accordance with Oregon and Federal OSHA requirements.
 2. Provide reasonably dry base of excavation.
 3. Prevent boiling of the excavation bottom.
 4. Filter native soil and prevent loss of soil through piping action.
 5. Preserve the undisturbed bearing capacity of subgrade soils at the bottom of the excavation.
 6. Draw down the groundwater level below and beyond the excavation bottom and sidewalls where shoring is not designed to resist hydrostatic pressures.
- K. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent floatation or movement of structures, pipelines and sewers.
- L. Discharge of removed groundwater shall be in accordance with State and Federal regulations. Water removed from excavations shall be discharged to a sedimentation tank(s). Groundwater shall be tested for contaminants prior to discharge. All discharges shall be approved by the local and State jurisdiction.
- M. It is the Contractor's responsibility to obtain all necessary local, state, and federal permits, permissions, and approvals for the selected discharge location.
- N. Discharge of groundwater removed by the dewatering system may be allowed to the Sanitation District wastewater collection system. Groundwater must meet specific quality and quantity requirements before discharge to the sewer is allowed. The Contractor shall coordinate with the Sanitation District and obtain approval for discharge to the sewer. If the Contractor elects to discharge elsewhere, it is the

Contractor's responsibility to obtain all necessary local, state, and federal permits, permissions, and approvals for the selected discharge location.

END OF SECTION

SECTION 32 11 00**PAVEMENT BASE COURSE****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Aggregate subbase
- B. Aggregate base
- C. Cement treated base
- D. Lime stabilization

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 01 50 50, Erosion Control
- C. Section 31 20 00, Earth Moving

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Report of Geotechnical Engineering Services – Elmonica, by NV5, January 12, 2022.
- B. ASTM:
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
 - 3. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 4. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- C. Oregon Standard Specifications for Construction, current edition
 - 1. Section 00600, Bases
 - 2. Section 00641.10(b), Aggregate Subbases
 - 3. Section 02630, Aggregate Bases

1.4 DEFINITIONS

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

- B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials. Perform work in accordance with Section 31 20 00, Earth Moving.

1.5 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.6 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.
- C. Perform installation of base materials under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the Owner. Notify the Geotechnical Engineer at least 24 hours prior to commencement of base material installation and at least 48 hours prior to testing.
- D. Do not mix or place cement treated base when the temperature is below is below 36 degrees F or when the ground is frozen.
- E. Finish surface of material to be stabilized prior to lime treatment shall be in accordance with Oregon Standard Specification for Construction Section 00600, Bases.
- F. Finish surface of the stabilized material after lime treatment shall be in accordance with Oregon Standard Specification for Construction Section 00600, Bases.

- G. Finish surface of cement treated base shall be in accordance with Oregon Standard Specification for Construction Section 00600, Bases.
- H. Do not project the finish surface of aggregate subbase above the design subgrade.
- I. Finish grade tolerance at completion of base installation: +0.05 feet

1.7 PROJECT CONDITIONS

- A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Owner.
- C. Provide dust and noise control in accordance with Section 01 10 00, Supplemental General Requirements.

PART 2 - PRODUCTS

2.1 AGGREGATE SUBBASE

- A. Material: *[Select applicable.]* Dense-Graded Aggregate or Open-Graded Aggregate in accordance with ODOT Standard Specification Section 00641.10(b), Aggregate Subbases.

2.2 AGGREGATE BASE

- A. Material: *[Select applicable.]* Dense-Graded Aggregate or Open-Graded Aggregate in accordance with ODOT Standard Specification Section 02630, Aggregate Bases.

2.3 CEMENT TREATED BASE

- A. Material: *[Select applicable.]* Class 1 or 2 maximum in accordance with Oregon Standard Specification for Construction Section 00600, Bases.

2.4 LIME STABILIZED SOILS

- A. Material: In accordance with Oregon Standard Specification for Construction Section 00600, Bases.

PART 3 - EXECUTION

3.1 GENERAL

- A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.2 WET WEATHER CONDITIONS

- A. Do not place or compact subgrade if above optimum moisture content.
- B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.3 AGGREGATE SUBBASE

- A. Spreading and Compacting: In accordance with ODOT Standard Specification Section 00641.44.(b), Aggregate Subbase and Shoulder Courses.

3.4 AGGREGATE BASE

- A. Watering, Spreading and Compacting: In accordance with ODOT Standard Specification Section 00641.44(a), Aggregate Base Courses & Section 00340, Watering.

3.5 CEMENT TREATED BASE

- A. Proportioning and Mixing Plant-Mixed: In accordance with Oregon Standard Specification for Construction Section 00600, Bases.

3.6 LIME STABILIZATION

- A. Lime stabilization shall conform to Oregon Standard Specification for Construction Section 00600, Bases and the following:
 - 1. Add lime in the amount specified by the Geotechnical Engineer.
 - 2. Lime treat subgrade soils from back of curb to back of curb to a depth specified by the Geotechnical Engineer.
 - 3. Mix in two mixing periods, both with the tines lowered to the same depth. Both mixing periods shall be monitored and verified by the Geotechnical Engineer. The second mixing shall occur at about 24 hours after the initial mixing.
 - 4. Compact and grade the lime mixed subgrade immediately after the second mixing.
 - 5. Compact the lime treated subgrade to 93 percent as determined by ASTM D1557.
 - 6. After application of the curing seal, do not allow traffic on the lime treated material for a period of 7 days in lieu of the 3 days specified in Caltrans Standard Specifications, Section 24.
 - 7. Proof-roll the stabilized subgrade after compacting to confirm that a non-yielding surface has been achieved. Yielding areas, if any, shall be mitigated. Mitigation could consist of over-excavation, utilization of stabilization fabric, or chemical treatment. Each case shall be addressed individually in the field by the Geotechnical Engineer.

3.7 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

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SECTION 32 12 16**ASPHALT PAVING****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Hot Mix Asphalt
- B. Tack coat
- C. Hot Mix Asphalt paving
- D. Hot Mix Asphalt overlay
- E. Speed bumps
- F. Asphalt curbs
- G. Pavement grinding
- H. Adjusting manholes, valves, monument covers and other structures to grade

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 31 20 00, Earth Moving
- C. Section 32 11 00, Pavement Base Course

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Report of Geotechnical Engineering Services – Elmonica, by NV5, January 12, 2022.
- B. ASTM
 - 1. D979: Standard Practice for Sampling Bituminous Paving Mixtures
 - 2. D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
 - 3. D2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
 - 4. D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
 - 5. D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
 - 6. D3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

- C. Oregon Standard Specifications for Construction (current edition) – Dense Graded HMAC Reference: Section 00744, Asphalt Slurry Seal Surfacing Reference: Section 00706, and Crack Sealing Flexible Pavements Reference: Section 00746.

1.4 DEFINITIONS

- A. ASTM: American Society for Testing Materials.
- B. OSSC: Oregon Standard Specifications for Construction (current edition).

1.5 QUALITY ASSURANCE

[Confirm Article A and B with project requirements]

- A. Testing Agency: Owner's Representative will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
- B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- C. Thickness of hot mix asphalt: In-place compacted thickness of asphalt courses will be determined according to ASTM D3549.
- D. Surface Smoothness: Finished surface of each asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D979.
 - 1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement may be determined by testing core samples according to ASTM D1188 or ASTM D2726.
 - a. One core sample may be taken for every 1000 square yard or less of installed pavement, but in no case will fewer than 3 cores be taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.
- F. Pre-installation Conference: Contractor, installer, and Owner shall meet at site to review paving operations, and acceptance of substrata surfaces.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
 - 1. Protect materials and maintain product temperature during delivery.

1.7 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Job-Mix Designs: Certificates signed by manufacturers certifying that each hot mix asphalt mix complies with requirements.
- C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.
- D. Product Data: Manufacturer's specifications and technical data including performance, construction, and fabrication information.
 - 1. Submit for job mix formulas (JMF).
 - 2. Submit for crack sealant materials.

1.8 SPECIAL WARRANTIES

- A. Contractor shall warranty installed pavement for a period of 2 years from date of Substantial Completion. When notified in writing from Owner, they shall promptly and without inconvenience and cost to Owner correct said deficiencies to comply with requirements.

1.9 ADVANCE NOTICES

- A. Notify Owner at least 48 hours before starting work of this section at each site.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Tack Coat: Minimum surface temperature of 60 F at application.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 F and rising at application.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 F at application.
 - 4. Reinforcing Fabric: Air temperature is 50 F and rising and pavement temperature is 40 F and rising.

PART 2 - PRODUCTS**2.1 CRUSHED ROCK PAVEMENT BASE**

- A. Under Dense Graded HMAC Mixture: Imported Clean 3/4"-0 or 1-1/2"-0 dense graded crushed rock or crushed gravel, free of foreign material and meeting the requirements of Oregon Standard Specifications for Construction (current edition) Section 02630, Base Aggregate.

2.2 HOT MIX ASPHALT

- A. Asphalt Mixture: The asphalt concrete mixture shall be a well-graded, uniform coated, durable mix of the mix type(s) as shown on the plans or approved by the Owner.

BROADBAND LIMITS

DENSE GRADED MIXTURE

Sieve Size Passing	Percentage of Total Aggregate (by weight) 1/2" Dense
1"	--
3/4"	99 - 100
1/2"	90 - 100
1/4"	52 - 80
No. 10	21 - 46
No. 40	8 - 25
No. 200*	3 - 8
Asphalt Cement	4 - 8

- B. Asphalt Cement (Binder): Per Oregon Standard Specifications for Construction (current edition). Use PG (Performance Grade) 64-22 for base courses and wearing course.
- C. Aggregate for Base Course Mix: Per Oregon Standard Specifications for Construction (current edition).
- D. Aggregate for Wearing Course (Top Lift of HMAC) Mix: Per Oregon Standard Specifications for Construction (current edition).
- E. Fine Aggregate: Per Oregon Standard Specifications for Construction (current edition).
- F. Mineral Filler: Finely ground particles of limestone, hydrated lime, or other mineral dust, free of foreign matter.
- G. Asphalt Tack Coat: Type CSS-1, CSS-1h, CMS-2, CMS-2S, CMS-2h, CRS-2, HFRS-2 or HFMS-2 emulsified asphalt (EA) conforming to Oregon Standard Specifications for Construction (current edition).
- H. Reclaimed Asphalt Pavement (RAP) Material: Shall not exceed 30% in the new pavement. Rap material not permitted in open graded or Level 4 HMAC pavement, in accordance with Oregon Standard Specifications for Construction (current edition). Asphalt mixtures including RAP to meet all normal specification and Oregon Standard Specifications for Construction (current edition) requirements.

2.3 JOB MIX FORMULA (JMF)

- A. Mix Formula: The Contractor shall submit a JMF for each mixture to be used on the project and meeting the Level 2 criteria of Oregon Standard Specifications for Construction (current edition).
- B. The Contractor shall supply the job mix design to the Owner ten (10) work days prior to production. The job mix formula shall be no more than five (5) years old.

2.4 HMAC PRODUCTION QUALITY CONTROL/ASSURANCE

- A. As specified for Level 2 HMAC in the Oregon Standard Specifications for Construction (current edition). Submit the appropriate documentation/reports to Owner for review.

2.5 CRACK SEALANT

- A. Sealants - Provide hot-poured sealants of the type intended for use in sealing cracks in asphalt concrete pavement that conform to the requirements of ASTM D6690 and AASHTO M 301.

2.6 ASPHALT SEAL COAT

- A. Asphalt seal coat materials, gradation, job mix formula, and mix design shall conform to the requirements of Oregon Standard Specifications for Construction (current edition) Section 00706: Emulsified Asphalt Slurry Seal Surfacing.

2.7 PAVEMENT MARKINGS

- A. Traffic paint shall be traffic marking paint two (2) coats, 18.0 mil minimum dry film thickness, Sherwin Williams, Benjamin Moor, Rodda, or approved. Color to match existing.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. If necessary, perform subgrade preparation or remediation in accordance with Section 31 20 00, Earth Moving.
- D. Notify Owner in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

3.2 WEATHER LIMITATIONS

- A. Surface Temperature: Asphalt concrete shall be placed on a dry prepared surface when the surface temperature is not less than specified below.

Nominal Specified Compacted Thickness <u>of Individual Courses</u>	
2" to 2-1/2"	50°F
2-1/2" and over	40°F

- B. Weather: Asphalt concrete shall not be placed during rain or other adverse weather conditions. However, if approved by the Owner, the mix in transit at the time the adverse conditions occur may be laid if the mix has been covered during transit and is at the specified temperature, if the foundation is free from pools or flow of water, and if all other requirements of these specifications are met. Asphalt concrete mixtures shall not be placed when the foundation is frozen or when, in the opinion of the Owner, existing or expected weather conditions will prevent the proper handling, finishing, or compaction of the mixtures.
- C. Ambient Temperature Caution: The Contractor is cautioned that placing asphalt concrete on cool days when the temperature is less than 60°F may require an adjustment in Contractor's normal placing and compaction procedures so that specified minimum compaction requirements will be met. The temperatures shown in the table in this section are not recommended temperatures for paving, but paving may be allowed at these temperatures on the condition that specified pavement compaction is achieved.

3.3 PAVEMENT GRINDING

- A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.
- B. Grind conforms as indicated.

3.4 SOIL STERILANT

- A. Furnish and apply to areas per manufacturer's specifications.

3.5 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS

- A. Bases: All bases and foundations on which the pavement is to be constructed shall meet the applicable specifications and be approved prior to the start of paving. Existing bases and foundations shall be reconditioned as specified or directed.
- B. Edges: Broken or ragged edges of existing paved surfaces underlying or abutting the new pavement shall be sawcut back to firm material. Surfaces against which asphalt concrete is to be placed shall be treated with an asphalt tack coat.

- C. Tack Coat: Prior to placing each lift of asphalt concrete, tack coat asphalt shall be applied to completely cover all cold longitudinal joint and all prepared existing asphalt and portland cement concrete surfaces. Immediately before applying the tack coat, the surface to be tacked shall be clean and dry. The application rate shall be between 0.05 and 0.20 gallons per square yard of surface area to achieve uniform, thorough coverage and as approved by the Owner. Emulsified asphalt temperature to be between 140 and 185°F and application to be in accordance with manufacturer's recommendations.
1. Allow tack coat to cure undisturbed before paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 TEMPERATURE CONTROL

- A. Temperature of Mixture:
1. The temperature of the mixture at the time it is placed in final position shall be within 10 degrees of 280°F. The Owner may adjust the lay-down temperature in 10-degree increments to attain maximum workability and compaction. In no case shall the lay-down temperature of mixture be less than 240°F.

3.7 COMPACTION

- A. Immediately after the asphalt concrete mixture has been spread, struck off and surface irregularities and other defects remedied, it shall be thoroughly and uniformly compacted with a roller, mechanical tamper, hot hand tamper, or heavy hand roller. Complete breakdown and intermediate compaction shall occur before the mix temperature drops below 180°F.
- B. General:
1. The type, number, and weight of rollers shall be sufficient to compact the mixture while it is still within the specified temperature range. Rollers shall not be operated in vibratory mode when the temperature of the mixture has dropped below 180 degrees.
 2. Steel roller wheels shall be moistened with water or other approved material to the least extent necessary to prevent pickup of mixture and not cause spotting or defacement of the surface of the mixture.
 3. Rollers shall be operated at speeds recommended by the roller manufacturer and slow enough to avoid displacement of the mixture. The maximum speeds shall be 3 miles per hour for steel-wheeled rollers and pneumatic-tired rollers, unless faster speeds are approved.
 4. Care shall be exercised not to displace the line and grade of edges. Displacement of any course occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of approved rakes and addition of fresh mixture when required.
 5. Any mixture that becomes loose and broken, contaminated, segregated, or is in any way defective, shall be removed and replaced with new mixture at no expense to the Owner.
 6. Finish rolling shall continue until all roller marks are eliminated.

7. Along curbs and walls, on walks, irregular areas, and other areas not practicably accessible to specified rollers, the mixture shall be compacted with approved self-propelled rollers, mechanical tampers, hot hand tampers, or heavy hand rollers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

C. Density Requirements:

1. The Contractor is responsible for process control and shall conduct sampling, testing, measurement and inspection. The contractor shall provide daily nuclear density testing (ODOT Test Method 310C-87) to develop rolling patterns necessary to achieve the minimum compaction requirement of 91 percent as determined by Rice Density Test AASHTO T 209 as modified by ODOT TM 306. This is in addition to Owner's testing as necessary to ensure the finished pavement meets specifications. Contractor to immediately take corrective measures when it is determined that specified compaction density is not achieved. If specified compaction density cannot be achieved the Contractor shall remove and replace the defective asphalt areas at the Contractor's expense. The Owner has the option of accepting these areas with a reduced payment to the Contractor.
2. Asphalt compaction below 88 percent as determined by Rice Density Test AASHTO T 209 as modified by ODOT TM 306 is not acceptable.
3. The Owner will determine the suitability of the final product through final acceptance testing. Results of these tests will be used to determine payment deductions, if any to be assessed against the Contract. The final density of each paving project location will be determined by averaging the results of a minimum of five (5) density tests taken with a nuclear gauge (ODOT TM 310C-87) at randomly selected locations within each paving project.
4. Paving in areas 6 feet wide or less and irregular areas not accessible by large rollers are not subject to the minimum compaction per (1) above.
5. The Owner shall take acceptance tests to verify that the work meets specifications.

3.8 COMPACTORS

- A. Rollers: Rollers shall be steel wheel, pneumatic tire, vibratory or a combination of these types. They shall be in good condition and capable of reversing without backlash.

3.9 CRUSHED ROCK PAVEMENT BASE PLACEMENT

- A. Placement and compaction shall conform to the requirements of Section 31 20 00, EARTH MOVING.

3.10 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Provide full depth asphalt section repair in existing pavement areas with alligator cracking, potholes, and severe grade depressions. Existing pavement shall be sawcut 1 foot back from area of local distress and existing pavement, base, and foundation

shall be removed to a suitable subgrade. The faces of the excavation shall be straight and vertical. Match existing pavement sections.

- B. Place asphalt within 24 hours of applying tack coat. Do not place HMAC pavement on the tack coat until the asphalt separates from the water (breaks), but before it loses its tackiness.
- C. Place up to 3 inch compacted thickness in one lift.
- D. Raise pavement elevation as necessary to remove depressions in the pavement surface. Match existing lines and grades.
- E. Compact pavement by rolling. Do not displace or extrude pavement from position. Use hand-operated compacting equipment in areas inaccessible to rolling equipment.
- F. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.11 PAVEMENT SMOOTHNESS

- A. Utility Structures: The joint between the pavement and the top surface of utility structures, such as manhole covers and valve boxes located in the traveled way, shall meet the pavement surface tolerances.
- B. Tolerance: The surface of the finished pavement shall be within 0.02 foot of the specified line, grade, and cross section.
- C. Texture: The completed surface of all courses of the mixture shall closely parallel that specified for the top surface of the finished pavement and shall be smooth, uniform on texture and conform to the specified crown and grade.
- D. Job control testing shall be performed with a 10 foot straightedge furnished and operated by the Contractor. The Owner may observe this testing, or the Owner may require additional testing to be performed under the Owner's supervision. Operations to eliminate the unacceptable pavement shall be corrected by the Contractor using a method or methods listed below and approved by the Owner.
- E. Roughness: When tests show the pavement is not within the above tolerances, the Contractor shall take immediate action to correct equipment or procedures in the paving operations to eliminate the unacceptable pavement roughness.
- F. Method of Correction: Any surface irregularities exceeding the above tolerances shall be corrected by the Contractor using a method or methods listed below and approved by the Owner.

3.12 PAVEMENT SURFACE CLEANING PRIOR TO SEAL COATING

- A. Preparation of Surface - Submit details of the proposed pavement cleaning for approval by the Owner prior to construction.
- B. Remove any organic materials in cracks or joints not removed during crack sealing as part of the pavement preparation.

3.13 ASPHALT SEAL COAT

- A. Asphalt seal coat application procedures shall conform to the requirements of Oregon Standard Specifications for Construction (current edition) Section 00706: Emulsified Asphalt Slurry Seal Surfacing.

3.14 CLEANING

- A. Trim and remove excess asphalt concrete accumulations from abutting structures such as curbs, manholes, catch basins, and other structures.
- B. Including work of other sections, clean, repair and touch-up, or replace when directed, products which have been soiled, discolored, or damaged by work of this section. Remove excess spilled material and debris from project site upon work completion or sooner, if directed.
- C. Upon completion of the work of this section promptly remove from the working area all scraps, debris, and surplus material.

3.15 JOINTS

- A. Construct joints to ensure continuous bond between adjoining paving sections in accordance with Oregon Standard Specifications for Construction (current edition).
 - 1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
 - 2. Clean contact surfaces and apply tack coat.
 - 3. Offset longitudinal joints in successive courses a minimum of 6 inches.
 - 4. Offset transverse joints in successive courses a minimum of 24 inches.
 - 5. Compact joints as soon as hot mix asphalt will bear roller weight without excessive displacement.

3.16 ADJUSTING MANHOLES, VALVES, MONUMENT COVERS AND OTHER STRUCTURES TO GRADE

- A. Remove pavement, using vertical cuts, as needed to remove frame and provide for concrete collar. Do not damage adjacent pavement.
 - 1. Circular Covers: Cut circle with radius 6 inches larger than cover and concentric with cover.
 - 2. Rectangular Covers: Cut rectangle 6 inches larger than cover on all sides.
- B. Install grade rings or blocking as needed to raise cover to finish grade.

- C. Pour concrete collar:
 - 1. Bottom of Collar: Top of existing collar or 6 inches below top of proposed collar, whichever is at a higher elevation.
 - 2. Top of Collar: Bottom of existing asphalt pavement.
 - 3. Apply tack coat to all exposed surfaces.
 - 4. Fill excavation with hot mix asphalt and, while still hot, compact flush with adjacent surface.

3.17 PROTECTION

- A. In addition to other required provisions for traffic, the following shall apply to pavement reconstruction and seal coating: No traffic or equipment shall come in contact with the compacted mixture until it has cooled and set sufficiently to prevent marking; edges shall be protected from being broken down; and edge drop-off(s) one inch or more in height shall be marked with approved reflectorized and/or flashing warning devices visible by day and night to the traveling public, and placed at spacings as specified by the Owner.
- B. Protect all work installed under this section.
- C. Replace at no additional cost to Owner, any damaged work of this section.

3.18 INSTALLATION TOLERANCES

- A. Hot Mix Asphalt Pavement:
 - 1. Total Thickness: Not less than indicated.
- B. Trench Patch:
 - 1. Compacted surface: Within 0.01 foot of adjacent pavement.
 - 2. Do not create ponding.
- C. Adjust Covers:
 - 1. Compacted surface: Up to 0.01 foot higher, and no lower, than adjacent pavement.
 - 2. Do not create ponding.

END OF SECTION

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SECTION 32 13 13
CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.
- B. Form construction and use in placing portland cement concrete pavement.
- C. Joints for portland cement concrete pavement.
- D. Finishing portland cement concrete pavement.
- E. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

- A. 01 10 00, Supplemental General Requirements
- B. 31 20 00, Earth Moving
- C. 32 11 00, Pavement Base Course
- D. 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Report of Geotechnical Engineering Services – Elmonica, by NV5, January 12, 2022.
- B. AASHTO Standard Specifications
 - 1. T132: Standard Method of Test for Tensile Strength of Hydraulic Cement Mortars
- C. ASTM Standards
 - 1. D36: Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
 - 2. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. A706: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
 - 4. A775: Standard Specification for Epoxy Coated Steel Reinforcing Bars.
 - 5. A934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.

6. A996: Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
 7. C94: Standard Specification for Ready-Mixed Concrete
 8. C603: Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
 9. C639: Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
 10. C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
 11. C679: ASTM C679-15 Standard Test Method for Tack-Free Time of Elastomeric Sealants
 12. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
 13. C793: Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
 14. C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 15. D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
 16. D1640: Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
 17. D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
 18. D2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
 19. D3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
 20. D6690: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- D. ODOT Standard Specifications, current edition
- E. ODOT Standard Plans, current edition
- F. Oregon Standard Specifications for Construction, current edition

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing and Materials
- C. ODOT: Oregon, Department of Transportation
- D. OSSC: Oregon Standard Specifications for Construction

1.5 QUALITY ASSURANCE

[Confirm Article A and B with project requirements]

- A. Testing Agency: Owner's Representative will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
- B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- C. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
- D. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.6 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
 - 1. Cementitious materials and aggregates
 - 2. Steel reinforcement and reinforcement accessories
 - 3. Admixtures
 - 4. Curing compound
 - 5. Applied finish material
 - 6. Bonding agent or adhesive
 - 7. Joint filler
 - 8. Joint Sealant
 - 9. Tie Bars
 - 10. Epoxy
 - 11. Backer Rods

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

- A. In accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.2 BASE MATERIAL

- A. In accordance with Section 32 11 00, Pavement Base Course.

2.3 TIE BARS

- A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A615, Grade 40 or 60
- B. Epoxy-coat in accordance with ODOT Standard Specification Section 02510.11, Epoxy-Coated Reinforcement, except bars must comply with ASTM A706; ASTM A996; or ASTM A615, Grade 40 or 60.
- C. Do not bend tie bars.

2.4 EPOXY

- A. Bond tie bars to existing concrete with epoxy resin in accordance with Oregon Standard Specifications for Construction section 00755.43.

2.5 SILICONE JOINT SEALANT

- A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	45 psi max.
Flow at 77° ± 1°F	ASTM C639 ^a	Shall not flow from channel
Extrusion Rate at 77° ± 1°F	ASTM C603 ^b	75-250 g per min.
Specific Gravity	ASTM D792 Method A	1.01 to 1.51
Durometer Hardness, at 0°F, Shore A, cured 7 days at 77° ± 1°F	ASTM C661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C793	No chalking, cracking or bond loss
Tack free at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM C679	Less than 75 minutes
Elongation, 7 day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	500 percent min.
Set to Touch, at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 77° ± 1°F	AASHTO T132 ^c	50 psi min.
Movement Capability and Adhesion, 100% extension at 0°F after air cured 7 days at 77° ± 1°F, and followed by 7 days in water at 77° ± 1°F	ASTM C719 ^d	No adhesive or cohesive failure after 5 cycles

Notes:

- a. ASTM Designation: C639 Modified (15 percent slope channel A).
 - b. ASTM Designation: C603, through 1/8 inches opening at 50 psi.
 - c. Mold briquets in conformance with the requirements in AASHTO Designation: T132, sawed in half and bonded with a 1/16 inches maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T132. Briquets shall be dried to constant mass at 212 ± 10°F.
 - d. Movement Capability and Adhesion: Prepare 12 inch x 1 inch x 3 inch concrete blocks in conformance with the requirements in ASTM Designation: C719. A sawed face shall be used for bond surface. Seal 2 inch of block leaving 1/2 inches on each end of specimen unsealed. The depth of sealant shall be 3/8 inches and the width 1/2 inches.
- B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.
 - C. Furnish to the Owner's Representative a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

2.6 ASPHALT RUBBER JOINT SEALANT

- A. Conform to the requirements of ASTM Designation: D6690 as modified herein or to the following:
 - 1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a No. 08 sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
 - 2. The Ring and Ball softening point shall be 135°F minimum, when tested in conformance with the requirements in ASTM D36.
 - 3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 400°F.
- B. The penetration requirements of Section 4.2 of ASTM Designation: D6690 do not apply. The required penetration at 77°F, 5 oz, 5s, shall not exceed 120.
- C. The resilience requirements of Section 4.5 of ASTM Designation: D6690 do not apply. The required resilience, when tested at 77°F, shall have a minimum of 50 percent recovery.
- D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D6690, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.
- E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the Plans. Provide manufacturer's instructions to the Owner's Representative. Do not place when the pavement surface temperature is below 50 °F.

2.7 PREFORMED COMPRESSION JOINT SEALANT

- A. Material: ASTM Designation: D2628.
 - 1. Number of cells: 5 or 6.
 - 2. Lubricant Adhesive: ASTM Designation D2835.
 - 3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacturer's recommendations to the Owner's Representative`.
- B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the Plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the Plans.

2.8 BACKER RODS

- A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell

polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

2.9 SLIP RESISTIVE AGGREGATE FINISH

- A. Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

PART 3 - EXECUTION

3.1 WATER SUPPLY

- A. Provide water supply in accordance with ODOT Standard Specification Section 00340.40, Watering.

3.2 SUBGRADE

- A. Prepare subgrade in accordance with ODOT Standard Specification Section 00756.41, Preparation of Base.

3.3 SOIL STERILANT

- A. Furnish and apply to areas indicated in accordance with Section 31 20 00, Earth Moving.

3.4 PLACING

- A. Prepare concrete in accordance with Oregon Standard Specifications for Construction section 00755 (reinforced), and section 00756 (plain).

3.5 SPREADING COMPACTING AND SHAPING

- A. Conform to the following:
 - 1. Stationary Side Form Construction: In accordance with ODOT Standard Specification Section 00755.50, Stationary Side-Form Construction.

3.6 INSTALLING TIE BARS

- A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the Plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 50 feet. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.
- B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:
 - 1. Drilling and bonding in conformance with the details shown on the Plans. Provide a two-component, epoxy-resin, conforming to the requirements of

ASTM Designation: C881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

<u>Temperature of Concrete</u>	<u>Required Class of Epoxy Resin</u>
Lower than 40° F	A
40° F through 60° F	B
Above 60° F	C

2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner's Representative, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Owner's Representative, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

3.7 JOINTS

- A. Construct joints in accordance with ODOT Standard Specification Section 00755.48, Joints.
 1. Construction Joints: In accordance with ODOT Standard Specification Section 00755.48.(c), Construction Joints.
 - a. Construct a construction joint at the end of each day's work, or where concrete placement is interrupted for more than 45 minutes, to coincide with the next weakened plane joint location.
 - b. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall

be at the Contractor's expense. Any excess material shall be become the property of the Contractor and shall be properly disposed of.

- c. Form construction joints with a special header board. Take care when forming construction joints to assure that the reinforcement and its supports are not displaced, distorted or otherwise disturbed. When concrete placement resumes, remove the header board so neither the reinforcement nor the bond between the reinforcement and the previously placed concrete is disturbed.
2. Contraction Joints: In accordance with ODOT Standard Specification Section 00759.49, Contraction Joints, except that the insert method of forming joints in pavement shall not be used.

3.8 FINISHING

- A. Finish concrete in accordance with Oregon Standard Specifications for Construction section 00755.

3.9 CURING

- A. Cure concrete in accordance with ODOT Standard Specification Section 00759.51, Curing.

3.10 SEALING JOINTS

- A. Liquid Joint Sealant Installation.
 1. The joint sealant detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the Plans.
 2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
 3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 2 inch on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of $1/4 \pm 1/32$ inches and a minimum pressure of 90-psi.
 4. Install backer rod as shown on the Plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer

rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 40°F or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.

5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the Plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the Plans.
6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the Plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the Plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

B. Preformed Compression Joint Seal Installation

1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of $1/4 \pm 1/32$ inches and a minimum pressure of 90 psi.

3.11 PROTECTING CONCRETE PAVEMENT

- A. Protect all work installed under this section.
- B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION

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PART 1 GENERAL

1.01 SUMMARY

- A. A. Section includes:
 - 1. Exterior decorative concrete finishes as indicated in the drawings.
 - 2. Concrete Mixes for exterior concrete receiving decorative concrete finishes.
- B. Related Sections:
 - 1. 03 10 00 – Concrete Forming and Accessories.
 - 2. 03 20 00 – Concrete Reinforcing.
 - 3. 03 30 00 – Cast-in-Place Concrete.
 - 4. 32 13 13 – Concrete Paving.

1.02 REFERENCES

- A. American Concrete Institute (ACI)
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM C 31 Practices for Making and Curing Concrete Test Specimens in the Field C 33 Specification for Concrete Aggregates
 - 2. ASTM C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 3. ASTM C 42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete C 94 Specification for Ready-Mixed Concrete
 - 4. ASTM C 143 Test Method for Slump of Hydraulic Cement Concrete C 150 Specification for Portland Cement
 - 5. ASTM C 172 Practice for Sampling Freshly Mixed Concrete
 - 6. ASTM C 231 Test Method for Sampling Air Content of Freshly Mixed Concrete by Pressure Method C 260 Specification for Air-Entraining Admixtures for Concrete
 - 7. ASTM C 494 Specification for Chemical Admixtures for Concrete
 - 8. ASTM D 994 Specification for Preformed Expansion Joint Filler for Concrete

1.03 SUBMITTALS

- A. A. General: Submit the following items in accordance with the Conditions of Contract and Division 01 – Submittal Procedures.
- B. B. Product Data: Submit product data for the materials listed in Part 2 meeting or exceeding specifications.
- C. C. Laboratory Test Reports: Submit concrete test materials test reports and mix design reports certifying that each material or item meets or exceeds the specifications.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:
 - 1. ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete "
 - 2. ACI 305 "Hot Weather Concreting "
 - 3. ACI 306 "Cold Weather Concreting "

4. ACI 308 "Standard Practice for Curing Concrete "
 5. ACI 347 "Recommended Practice for Concrete Formwork "
- B. Mock-up Panels: Prepare one mock-up panel at the project site to demonstrate proficiency of the contractor as well as determine the best procedures and degree of sand or aggregate exposure. Mock-up panels shall be a minimum of 3' x 3'. Contractor shall use the methods and materials proposed for use on the final installation. Uniformity in appearance of each panel shall be the responsibility of the contractor. The mock-up panel shall be approved by the owner's representative and shall serve as a standard of appearance for the final work to be produced.
- C. Quality Control:
1. It is the responsibility of the contractor confirm concrete meets or exceeds the specifications of the concrete mixes in Part 2. The contractor shall be responsible for providing Quality Control Testing upon Owner Request.
 2. Quality Control Testing During Construction: Contractor will engage independent concrete testing service for quality control during concrete construction operations upon owner request.
 3. Notify owner's representative at least two (2) working days in advance of field operations requiring concrete testing, or of resumption of operations after stoppages.
 4. Coordinate concreting operations with testing service to facilitate quality control testing.
 5. Sample and test concrete during placement as follows:
 - a. Sampling Fresh Concrete: ASTM C172: except modified for slump to conform with ASTM C94
 - b. Slump: ASTM C143; test one for each concrete load at point of discharge and one for each set of compressive strength test specimens.
 - c. Air Content ASTM C231: pressure method: one for each set of compressive specimens.
 - d. Compressive Strength Tests: ASTM C39; one (1) set for each 150 cubic yards or fractions thereof, of concrete class placed in any one day or for each 5,000 sq. ft. of surface area placed; two (2) specimens tested seven (7) days, three (3) specimens tested twenty-eight (28) days and one (1) specimen retained in reserve for later testing if required.

PART 2 PRODUCTS

2.01 CONCRETE SURFACING TYPE I

- A. See Civil for concrete finish and mix

2.02 CONCRETE SURFACING TYPE II

- A. Finish:
- B. Manufacturer: GCP Applied Technologies.
- C. Supplier: Dayton Superior.

- D. Application: Spray Applied per manufacturer instruction.
- E. Product: Top Cast Surface Retarders.
- F. Etch Depth Code: 05.
- G. Package Color: Powder Blue Violet.
- H. Exposed Aggregate Size: Sandblast finish.
- I. Concrete Mix:
 - 1. Supplier: CalPortland or approved equal.
 - 2. Mix ID: 4020FS or approved equal.

2.03 CONCRETE SURFACING TYPE III

- A. Finish:
 - 1. Manufacturer: GCP Applied Technologies.
 - 2. Supplier: Dayton Superior.
 - 3. Application: Spray Applied per manufacturer instruction.
 - 4. Product: Top Cast Surface Retarders.
 - 5. Etch Depth Code: 15.
 - 6. Package Color: Yellow.
 - 7. Exposed Aggregate Size: 1/8" to 1/4"
- B. Concrete Mix:
 - 1. Supplier: CalPortland or approved equal.
 - 2. Mix ID: 4020FS or approved equal.

PART 3 EXECUTION

3.01 CONCRETE FINISHING

- A. Exposed Sand Finishes: The use of a rolling tamper, jitterbug or rolling jitterbug shall be considered when producing micro etched concrete surfaces. This will enable the finisher to create a denser surface paste with no obstruction due to the appearance of coarse aggregate, allowing for a uniform sand texture.
- B. Protect all areas, aluminum trim, curbs, borders and adjacent concrete and masonry surfaces, pavers, stones etc. that are not to receive retarder finish prior to concrete placement and retarder application using manufacturer recommended Surface Protectant.
- C. Place concrete in the manner prescribed in section 32 13 13.
- D. Allow the bleed water to evaporate the surface. It can then be floated using a wooden hand float or a bull-float preferably wooden to close the surface and surround the coarse aggregate with cement paste. Float to a uniform appearance. Create tight dense smooth surface.
- E. To reduce the rate of evaporation of moisture from the concrete use AquaFilm® J74RTU or approved equal during the finishing process.
- F. Do not burnish the surface or allow the micro etched surface to prematurely dry prior to the application surface retarder.

G. Concrete Surface Retarders

1. Spray Applied, film forming top surface retarder, designed for specific sized aggregates and finish requirements. Provide even and complete coverage.
2. Soon after the final seal finish has been completed, spray specified surface retarder using a low-pressure sprayer with a 0.5gpm tip at a rate of 200-350 sq./ft. per gallon in a full hiding coat.
3. Do not cover treated surfacing until completely dry.

3.02 CONCRETE SURFACE REPAIRS

- A. Section 32 13 13.

END OF SECTION

SECTION 32 13 18**CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Materials for portland cement concrete
- B. Aggregate and aggregate grading for portland cement concrete
- C. Water for portland cement concrete
- D. Admixtures for portland cement concrete
- E. Proportioning for portland cement concrete
- F. Mixing and transporting portland cement concrete
- G. Formwork for cast in place portland cement concrete
- H. Embedded materials for portland cement concrete
- I. Steel reinforcement for portland cement concrete
- J. Placing and finishing portland cement concrete
- K. Curing portland cement concrete
- L. Protecting portland cement concrete

1.2 RELATED SECTIONS

- A. Section 32 12 16, Asphalt Paving
- B. Section 32 13 13, Concrete Pavement

1.3 RELATED DOCUMENTS

- A. ASTM Standards
 - 1. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 3. C94, Standard Specification for Ready-mixed Concrete
 - 4. C150, Standard Specification for Portland Cement
 - 5. C260, Standard Specification for Air-Entraining Admixtures for Concrete

6. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 7. C494, Standard Specification for Chemical Admixtures for Concrete.
 8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Portland Cement
 9. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
 10. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
 11. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- B. Oregon Standard Specifications for Construction, current edition.

1.4 DEFINITIONS

- A. ASTM: American Society for Testing and Materials
- B. OSSC: Oregon Standard Specifications for Construction

1.5 SUBMITTALS

- A. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the Plans. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.
- B. Reinforcing Steel Shop-Drawings

1.6 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with section 00440 of the Oregon Standard Specifications for Construction
1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.
- B. Certifications:
1. Provide Owner's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in

accordance with the herein requirements of the OSSC and produces the required compressive strength under like conditions.

- c. Statement of type and amount of any admixtures.
2. Provide Owner's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.7 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall be considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in section 00440 of the OSSC.
- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be poured to the specifications of section 00759 of the OSSC.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

- A. General: Type II or Type V cement conforming to the requirements of ASTM C150. Contractor may substitute pozzolan for portland cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C618.

2.2 AGGREGATE AND AGGREGATE GRADATION

- A. General: Fine and coarse aggregates shall be $\frac{3}{4}$ inch maximum size; clean and crushed aggregate free of materials which may cause staining. Aggregates shall conform to the requirements of section 02690 of the Oregon Standard Specifications for Construction.
- B. Aggregate Size and Gradation: Conform to the requirements of section 00440 of the OSSC.

2.3 WATER

- A. General: Water shall be clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material, and not detrimental to concrete per ASTM C94. Water shall conform to the requirements of section 02020 of the OSSC, for mixing and curing portland cement concrete and for washing aggregates.

2.4 CHEMICAL ADMIXTURES

- A. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Admixtures shall conform to the requirements of section 02040 of the Oregon Standard Specifications for Construction and as noted herein or on the Plans.
1. Air-Entraining Admixture: ASTM C260/C260M
 2. Water-Reducing Admixture: ASTM C494/C494M, Type A
 3. Retarding Admixture: ASTM C494/C494M, Type B
 4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D
 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F
 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G
 7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II

2.5 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for the following items shall be designated as follows:
1. Curbs, Gutters, and Sidewalks: Minor concrete.
 2. Cast in Place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.
 3. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
 4. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of portland cement per cubic yard of concrete.
 5. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.

2.6 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless specified otherwise herein or on the Plans, expansion joint thickness shall be as follows:
1. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½ inch
 2. Structures: As indicated

2.7 REINFORCEMENT AND DOWELS

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM A615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details

shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.

- B. Slip dowels, where noted or called for on the Plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM A1064. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM A1064.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.8 FORMS

- A. Conform to the requirements of Section 0440 of the Oregon Standard Specifications for Construction.
- B. Tolerance: Not to deviate more than ¼ inch in 10 feet in grade and alignment.

2.9 PRECAST CONCRETE STRUCTURES

- A. Conform to section 00759 of the Oregon Standard Specifications for Construction.

2.10 CONCRETE VEHICULAR PAVEMENT

- A. General: See Section 32 13 13, Concrete Pavement.

PART 3 - EXECUTION

3.1 STRUCTURAL EXCAVATION

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density as determined by ASTM D1557.

- C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

3.2 BRACING AND SHORING

- A. Conform to Oregon and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Consulting Engineer for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in Oregon. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.3 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.4 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4 inches.
 - 2. Surfaces poured against earth: 3 inches.
 - 3. Formed surfaces exposed to earth or weather: 2 inches.
 - 4. Slabs, walls, not exposed to weather or earth: 1 inch.
- D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.5 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

- A. Transit mix concrete in accordance with the requirements of ASTM Designation C94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner's Representative.
- B. Do not hand mix concrete for use in concrete structures.

3.6 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.

- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 PLACING ACCESSORY MATERIALS

- A. Curing Compounds:
 - 1. Regular Portland Cement Concrete: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.
- D. Leave edge forms in place at least 24 hours after pouring.

3.9 DECORATIVE SURFACING CONSTRUCTION

- A. Decorative surfacing concrete walks, concrete median islands or other installations shall be formed and placed as a concrete slab conforming to the details shown or noted on the Plans.

3.10 FIELD QUALITY CONTROL

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.
- B. No concrete shall be placed prior to approval of forms.

- C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Conform the finish grade and cross section of concrete improvements to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances ACI 117 and as follows:
 - 1. Elevation: $\frac{1}{4}$ inch.
 - 2. Thickness: Plus $\frac{3}{8}$ inch, minus $\frac{1}{4}$ inch.
 - 3. Surface: Gap below 10 foot long, unlevelled straightedge not to exceed $\frac{1}{4}$ inch.
 - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 - 5. Vertical Alignment of Tie Bars and Dowels: $\frac{1}{4}$ inch.
 - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: $\frac{1}{2}$ inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel $\frac{1}{4}$ inch per 12 inches.
 - 8. Joint Spacing: 3 inches, unless otherwise indicated.
 - 9. Contraction Joint Depth: Plus $\frac{1}{4}$ inch, no minus.
 - 10. Joint Width: Plus $\frac{1}{8}$ inch, no minus.

3.11 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

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SECTION 32 13 75**CONCRETE CURBS AND GUTTERS****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Portland cement concrete curbs and gutters, sidewalk, curb ramps and driveways.

1.2 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 11 00, Pavement Base Course
- C. Section 32 13 13, Concrete Pavement
- D. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Report of Geotechnical Engineering Services – Elmonica, by NV5, January 12, 2022.
- B. American society for Testing and Materials (ASTM)
 - 1. A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 2. D1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- C. ODOT Standard Specifications, current edition
- D. Oregon Standard Specifications for Construction, current edition

1.4 DEFINITIONS

- A. ASTM: American Society for Testing Materials
- B. ACI: American Concrete Institute
- C. OSSC: Oregon Standard Specifications for Construction

1.5 SUBMITTALS

- A. Submittal procedures shall be as outlined in Section 01 10 00 – Supplemental General Requirements.

- B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Owner. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.6 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with section 00759 of the Oregon Standard Specifications for Construction
- B. Certifications:
 - 1. Provide Owner at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the ODOT Standard Specifications and produces the required compressive strength under like conditions.
 - 2. Settlement of type and amount of any admixtures.
 - 3. Provide Owner, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.7 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard specified by section 00756 of the Oregon Standard Specifications for Construction.
- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be plain concrete pavement as specified by the Oregon Standard Specifications for Construction section 00756

PART 2 - PRODUCTS

2.1 GENERAL

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.2 PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for items in this section shall be plain concrete pavement as specified by the Oregon Standard Specifications for Construction section 00756
- B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:
 - 1. Compressive Strength:
 - a. Typical: 3000 psi, minimum at 28 days, unless otherwise indicated.
 - b. Curbs & Gutters: 3500 psi, minimum at 28 days.
 - 2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer, limited to flatwork only); 4 inches for other concrete.
 - 3. Water/Cement Ratio: 0.5

2.3 CURBS AND GUTTERS FORMS

- A. Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

2.4 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.
- B. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
 - 1. Curbs, Curb Ramps, Island Paving, Driveways and Gutter Depressions: 1/4 inch

2.5 REINFORCEMENT AND DOWELS

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

- B. Form, place and finish concrete curbs, gutters, walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of section 00759 of the Oregon Standard Specifications for Construction.
- C. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12 inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6 inch deep lift of asphalt concrete after gutter form is removed.

3.2 SUBGRADE

- A. Conform to Section 00759 of the Oregon Standard Specifications for Construction.

3.3 SOIL STERILANT

- A. Furnish and apply an oxidation granular preemergent soil sterilant to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.

3.4 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.5 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.

- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4 inches
 - 2. Surfaces poured against earth: 3 inches
 - 3. Formed surfaces exposed to earth or weather: 2 inches
 - 4. Slabs, walls, not exposed to weather or earth: 1 inch
- D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.6 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 EXPANSION JOINTS

- A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch smooth slip dowels in the positions shown or noted on the detail drawings.

- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.8 WEAKENED PLANE JOINTS

- A. Construct weakened plane joints in concrete curbs, gutters, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.
- C. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.9 FINISHING CONCRETE

- A. Finish curb and gutter in conformance with the applicable requirements of section 00759.50 of the Oregon Standard Specifications for Construction.
- B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.
- C. Provide a broom finish to all horizontal surfaces perpendicular to the path of travel on surfaces used by pedestrians:
 - 1. Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.
 - 2. Surfaces Sloped Greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.10 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave edge forms in place at least 24 hours after pouring.

3.11 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

- A. New curb or gutter is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint.

Drill and insert ½ inch diameter by 12 inch long dowels at 24 inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.

- B. A cold joint to the existing curb is not acceptable.

3.12 FIELD QUALITY CONTROL

- A. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.
- B. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in section 00759 of the Oregon Standard Specifications for Construction.

3.13 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

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SECTION 32 15 00
LANDSCAPE AGGREGATE SURFACING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Landscape aggregate surfaced area as indicated on the drawings.
 - 2. Metal edging as indicated on the drawings.

1.03 SUBMITTALS

- A. Product Sample:
 - 1. Two-quart sample of the Landscape Aggregate Surfacing material(s) indicated on the drawings.
- B. Product Data:
 - 1. Landscape Geotextile Fabric and Drainage Layers.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver aggregate materials to site until all preparations for installation are complete. Install immediately after delivery.
- B. Do not store materials on site.
- C. Handle and process all material as needed to maintain segregation of different materials and prevent mixing and contamination with soils, debris, and other extraneous materials.
- D. Do not overwork material and cause separation of different grades of material.

1.05 SEQUENCING AND SCHEDULING

- A. Adjacent fencing, pavements, curbs, and landscape grading shall be completed prior to installing the materials.
- B. All subgrade work shall be complete and all below ground improvements shall be in place before filter fabric is placed and aggregate is installed.
- C. Installation of soil separation fabric and basalt rubble shall be a single continuous operation. After rubble and finish work is complete no equipment and materials are to be on the area. The only equipment allowed to run on the base aggregates is that required to install the finish layer of material.

PART 2 PRODUCTS

2.01 AGGREGATE (DECORATIVE) SURFACING TYPE I

- A. Supplier: Oregon Decorative Rock
- B. Type: Mexican Beach Pebbles
- C. Size: 2" to 3"
- D. Depth: 3"
- E. Quantity: Per plan
- F. Landscape Geotextile Fabric and Drainage Layers: Non-woven Geotextile Fabric:
 - 1. Mirafi 140N or approved equal
- G. Installation: Per detail.

2.02 AGGREGATE (MAINTENANCE STRIP) SURFACING TYPE II

- A. Product/ Size: 3/4" clean crushed.
- B. Supplier: Portland Rock and Landscape Supply
- C. Depth: 3"
- D. Quantity: Per plan
- E. Installation: Per detail
- F. Landscape Geotextile Fabric and Drainage Layers: Non-woven Geotextile Fabric:
 - 1. Mirafi 140N or approved equal

2.03 EDGE RESTRAINT

- A. Material: Steel Edging
- B. Supplier: Border Concepts
- C. Type: Border Stretch, 1/8-inch Thick by 6-inches tall by 10-feet long
- D. Color: Black
- E. Requirements:
 - 1. Edge restraints required on all installations of crushed aggregate surfacing where crushed aggregate surfacing is not otherwise permanently restrained from horizontal movement by adjacent building hardscape or curb.
 - 2. Installation per manufacturer's specifications and guidelines except where stricter requirements are called for herein.
 - 3. Install metal edge restraint with stakes extending a minimum of 12 inches below finished grade. Install a minimum of 7 stakes per section of edging. Install temporary wood spikes and edging lumber during layout, compaction, and installation operations to insure straight lines.
 - 4. Top of edge restraint to be flush with adjacent pavement or finish grade of landscaping.

PART 3 EXECUTION

3.01 LAYOUT AND SCHEDULING

- A. Field stake location of edges of landscape aggregate surfacing areas. Review with Owner for approval. Adjust layout stakes as directed.
- B. Prior to start of work, coordinate schedule of the work with other trades.

3.02 INSTALLATION

- A. Install landscape geotextile fabric and drainage layers as indicated in the drawings.
- B. Spread landscape aggregate material evenly across boundary area.
- C. Install and compact aggregate to meet adjacent grades.
- D. Depth of the base material shall vary as needed to provide a level top grade while conforming to the cross slope indicated in the drawings. The minimum depth for this material is indicated in the drawings.

3.03 PROTECTION

- A. Protect Geotextile fabric from damage and contamination. Remove and replace unacceptable material as specified in Division 02.
- B. Protect landscape aggregate surfacing materials from mixing and contamination with soils and other aggregates. Provide protection barriers and covers as needed.
- C. Remove all granular materials which become contaminated with debris or soils. Replace with material as specified herein.

3.04 GRADING

- A. shall conform to Section 31 00 00.
- B. All spoils shall be removed from subgrade and all subgrade areas shall be rolled and compacted to 95%.
- C. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified areas. Compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades. Finish surfaces free from irregular surface changes.

3.05 MATERIAL STORAGE

- A. Stockpile satisfactory excavated materials where directed, until required for back-fill or fill. Place, grade and shape stockpiles for proper drainage.
- B. Locate and retain soil materials away from edge of excavations and drip lines of trees to remain.
- C. Dispose of excess soil material and waste materials as herein specified.

3.06 TOLERANCES

- A. Grade and Surface-Smoothness Requirements
- B. Finish grades shall be smooth with no depressions or high spots and shall have positive drainage to a maximum of 1.5 cross slope%, away from all building foundations.

- C. Edge restraints shall be in line with proposed grades without dips and rises.
- D. Edge restraints shall be installed in straight lines parallel to building face. Horizontal deviations not to exceed 1/4" in 3 feet.
- E. Any edge restraint and drip edge area not meeting the smoothness or horizontal requirements shall be reinstalled to the satisfaction of the Owner.

3.07 MAINTENANCE

- A. After the completion of construction and prior to acceptance by the Owner's Representative, the Contractor shall maintain and repair crushed surfacing by installing additional Crushed Surfacing Top Course as needed to repair areas of erosion and settling within crushed surfacing.

3.08 CLEANUP

- A. Remove surplus materials, debris, trash and waste and legally dispose of them off Owner's property.

END OF SECTION

SECTION 32 17 13**PARKING BUMPERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes concrete precast wheel stops.

1.2 RELATED SECTIONS

- A. Section 01 00 00, Supplemental General Requirements

1.3 SUBMITTALS

- A. Follow submittal procedure outlined in accordance with Section 01 10 00, Supplemental General Requirements.
- B. Submit product data for each type of product.

PART 2 - PRODUCTS**2.1 PARKING BUMPERS**

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 2500 psi minimum compressive strength, 5½ inches high by 7½ inches wide by 48 inches long (or length as shown on plans). Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed vertical holes through wheel stop for anchoring to substrate.
 - 1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
 - 2. Mounting Hardware: Galvanized-steel dowel, ½ inch diameter, 24 inch minimum length.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Oldcastle Precast
 - 2. Bertelson Precast
 - 3. Barco Products, or approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION

SECTION 32 17 23**PAVEMENT MARKINGS****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Removal of existing traffic stripes and pavement markers
- B. Removal of existing signs
- C. Cleaning and sweeping of streets before application of traffic stripes and pavement markings
- D. Materials and application for traffic stripes and pavement markings
- E. Materials and application for pavement markers
- F. Traffic control signs and street name signs
- G. Object markers
- H. Survey monuments

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. ODOT Standard Specifications, current edition
- B. ODOT Standard Plans, current edition
- C. ODOT Traffic Manual, current edition
- D. Oregon Standard Specifications for Construction, current edition
 - 1. Section 00800, Permanent Traffic Safety and Guidance Devices
 - 2. Section 00850, Common Provisions for Pavement Markings
 - 3. Section 00855, Pavement Markers
 - 4. Section 00860, Longitudinal Pavement Markings – Paint
 - 5. Section 00865, Longitudinal Pavement Markings – Durable
 - 6. Section 00866, Longitudinal Pavement Markings – High Performance
 - 7. Section 00867, Transverse Pavement Markings – Legends and Bars
 - 8. Section 00900, Permanent Traffic Control and Illumination Systems
 - 9. Section 00905, Removal and Reinstallation of Existing Signs

10. Section 00910, Wood Sign Posts
11. Section 00920, Sign Support Footings
12. Section 00921, Major Sign Support Drilled Shafts
13. Section 00930, Metal Sign Supports
14. Section 00940, Signs
15. Section 00941, Sign Covers

- E. The regulations, standards, and tests of the State of California Department of Transportation Materials and Research Division, edition in effect at time of date on Plans.
- F. Professional Land Surveyor's Act, Business and Professions Code §§ 8700 – 8805

1.4 SUBMITTALS

- A. Submit product data for each of the following in accordance with Section 01 10 00, Supplemental General Requirements:
 1. Traffic paint
 2. Pavement markers and adhesives
 3. Reflectorized markers and posts

1.5 QUALITY ASSURANCE

- A. Deliver certificates showing conformance with this specification to the Owners Representative with each shipment of materials and equipment to the Project site.
- B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

1.6 PROJECT CONDITIONS

- A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the Owners Representative.
- B. Thoroughly cure new asphalt concrete and portland cement concrete before application of stripes, markings or markers.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC STRIPES AND MARKING

- A. Thermoplastic striping and marking materials shall be in accordance with Oregon Standard Specifications for Construction section 00850.10, unless noted otherwise herein or on the Plans.
- B. Glass Beads shall be in accordance with Oregon Standard Specifications for Construction section 00225.12. Glass Beads, unless noted otherwise herein or on the Plans.

- C. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

2.2 PAINTED STRIPES AND MARKINGS

- A. Painted striping and marking materials shall be in accordance with Oregon Standard Specifications for Construction section 00850.10, unless noted otherwise herein or on the Plans.
- B. Glass Beads shall be in accordance with Oregon Standard Specifications for Construction section 00225.12. Glass Beads, unless noted otherwise herein or on the Plans.

2.3 PAVEMENT MARKERS

- A. Pavement Markers shall be in accordance with Oregon Standard Specifications for Construction section 00850.10, Pavement Markers, and as indicated on the Plans.
- B. Material
 - 1. Non-reflective Material shall be in accordance with Oregon Standard Specifications for Construction section 00850.10, Non-Reflective Pavement Markers.
 - 2. Retroreflective Material shall be in accordance with Oregon Standard Specifications for Construction section 00850.10, Retroreflective Pavement Markers.
- C. Adhesive:
 - 1. Adhesive Material shall be in accordance with Oregon Standard Specifications for Construction section 00850.10, Hot Melt Bituminous Adhesive.

2.4 TRAFFIC CONTROL SIGNS

- A. General: Traffic control signs shall be in accordance with Oregon Standard Specifications for Construction Section 00940, Signs.
- B. Sign Panels shall be in accordance with Oregon Standard Specifications for Construction Section 00940, Signs. Conform type (regulatory or warning), size, shape and pattern to the State of Oregon, Department of Transportation, Traffic Manual, edition in effect at the date of the Plans.
- C. Posts:
 - 1. Metal Posts shall be in accordance with Oregon Standard Specifications for Construction Section 00930, Metal Sign Supports.
 - 2. Wood Posts shall be in accordance with Oregon Standard Specifications for Construction Section 00910, Wood Posts.

- D. Mounting Hardware shall be in accordance with C Oregon Standard Specifications for Construction Section 00930, Metal Sign Supports, Sign Panel Fastening and Mounting Hardware, unless otherwise specified.
- E. Post Foundations: Conform to Oregon Standard Specifications for Construction Section 00930, Metal Sign Supports.

2.5 STREET NAME SIGNS

- A. Conform to manufacturer, style, size, and shape shown on the Plans.
- B. Posts: 2 inch inside diameter steel pipe unless noted otherwise on the Plans. Posts shall be in accordance with Oregon Standard Specifications for Construction Section 00930, Metal Sign Supports.
- C. Post Foundations: Portland cement concrete in accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.6 REFLECTORIZED OBJECT MARKERS

- A. ReflectORIZED Metal Object Markers: In accordance with Oregon Standard Specifications for Construction Section 00940, Metal Signs. Marker type shall be as shown on Plans.
- B. Posts: Metal posts shall be in accordance with Oregon Standard Specifications for Construction Section 00930, Metal Sign Supports.
- C. Mounting Hardware: In accordance with Oregon Standard Specifications for Construction Section 00930, Metal Sign Supports.

PART 3 - EXECUTION

3.1 REMOVAL OF TRAFFIC STRIPES, PAVEMENT MARKINGS AND PAVEMENT MARKERS

- A. Where blast cleaning is used for the removal of painted traffic stripes and pavement markings, or for removal of objectionable material, remove the residue, including dust and water, immediately after contact with the surface being treated. Remove by a vacuum attachment operating concurrently with the blast cleaning operation.
- B. Where grinding is used for the removal of thermoplastic traffic stripes and pavement markings; remove the residue by means of a vacuum attachment to the grinding machine. Do not allow the residue to flow across or be left on, the pavement.
- C. Where markings are to be removed by blast cleaning or by grinding, the removed area shall be approximately rectangular so that no imprint of the removed marking remains on the pavement.
- D. Waste from removal of yellow painted traffic stripe may contain lead chromate. Residue produced when yellow paint is removed may contain heavy metals in

concentrations that exceed thresholds established by OSHA and may produce toxic fumes when heated. As such, when grinding or other methods approved by the Owner's Representative are used to remove yellow painted traffic stripes, the removed residue, including dust, shall be collected and contained immediately. The Contractor shall submit a written work plan for the removal, storage, and disposal of yellow painted traffic stripe to the Owner's Representative for approval not less than fifteen (15) days prior to the start of the removal operations. Removal operations shall not be started until the Owner's Representative has approved the work plan.

- E. Contractor will be responsible for repairing any damage to the pavement during removal of pavement markers. Damage to the pavement, resulting from removal of pavement markers, shall be considered as any depression more than 1/4-inch deep.

3.2 TEMPORARY PAVEMENT MARKERS

- A. If permanent pavement markers cannot be installed immediately, and the street or road is to be placed in service, install short term, temporary pavement markers on the new pavement prior to opening the street or road to traffic.
- B. Place markers, at a minimum, of 24 feet on centers, or as required by the governmental agency having jurisdiction, in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways.

3.3 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements Oregon Standard Specifications for Construction section 00850.10.

3.4 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Oregon Standard Specifications for Construction section 00850.10.

3.5 PAVEMENT MARKERS

- A. Place in accordance with Oregon Standard Specifications for Construction section 00855.
- B. Pavement recesses are not required. Markers shall be installed accurately to the line established by the Owner's Representative. No markers shall be installed until the surface has been approved by the Owner's Representative.

3.6 TRAFFIC CONTROL SIGNS

- A. Install in accordance with Oregon Standard Specifications for Construction section 00900, the applicable requirements of the State of Oregon Department of Transportation Maintenance Manual and the details shown on the Plans.

- B. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.
- C. After erection, damage to traffic sign faces shall be touched up or the sign replaced.

3.7 STREET NAME SIGNS

- A. Install in accordance with the manufacturer's instructions and as shown on the Plans.
- B. Horizontal location shall be as shown on the Plans.
- C. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

3.8 REFLECTORIZED OBJECT MARKERS.

- A. Install in accordance with Oregon Standard Specifications for Construction section 00855.40, except that the metal marker posts shall not be driven in place without prior approval of the Owner's Representative.
- B. Install at locations shown on the Plans.

3.9 PROTECTION

- A. Protect the newly installed traffic stripes and pavement markings from damage until the material has cured.
- B. Replace any traffic stripes or pavement markings or markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

3.10 RESTORATION OF EXISTING IMPROVEMENTS

- A. Existing signs striping or other markings removed or damaged due to the installation of new facilities shall be replaced in kind.
- B. Existing landscaping or planting removed, damaged or disturbed due to the installation of traffic control signs or street name signs shall be replaced in kind.

END OF SECTION

**SECTION 32 17 26
TACTILE WARNING SURFACING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.02 REFERENCE STANDARDS

- A. 49 CFR 37 - Transportation Services for Individuals with Disabilities (ADA) current edition.
- B. AASHTO LRFD - Bridge Design Specifications 2020.
- C. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- D. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- E. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser 2021.
- F. ASTM C903 - Standard Practice for Preparing Refractory Specimens by Cold Gunning 2015 (Reapproved 2020).
- G. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine 2017.
- H. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents 2021.
- I. ASTM D570 - Standard Test Method for Water Absorption of Plastics 2022.
- J. ASTM D638 - Standard Test Method for Tensile Properties of Plastics 2022.
- K. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics 2015.
- L. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials 2017.
- M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- N. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials 2021.
- O. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way 2011.
- P. SAE AMS-STD-595 - Colors Used in Government Procurement 2017a.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's product data, standard details, details specific to this project; written installation and maintenance instructions.
- C. Shop Drawings: Submit plan and detail drawings. Indicate:
 - 1. Locations on project site. Demonstrate compliance with referenced accessibility standards.

2. Sizes and layout.
3. Pattern spacing and orientation.
4. Attachment and fastener details, if applicable

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company certified in writing by product manufacturer as having successfully completed work substantially similar to the work of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to project site in manufacturer's protective wrapping and in manufacturer's unopened packaging.
- B. Store covered and elevated above grade and in manufacturer's unopened packaging until ready for installation. Maintain at ambient temperature between 40 and 90 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plastic Tactile and Detectable Warning Surface Tiles:
 1. Access Tile, a brand of Access Products, Inc; ____: www.accesstile.com/#sle.
 2. ADA Solutions, LLC; ____: www.adatile.com/#sle.
 3. Armor-Tile, a brand of Engineered Plastics, Inc; ____: www.armortiletransit.com/#sle.
 4. VANGUARD ADA Systems of America; Product: Detectable Warning (Truncated Dome): www.vanguardonline.com.
 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TACTILE AND DETECTABLE WARNING DEVICES

- A. Plastic Tactile and Detectable Warning Tiles: ADA Standards compliant, glass fiber and carbon fiber reinforced, exterior grade, matte finish polyester sheet with truncated dome pattern, solid color throughout, internal reinforcing of sheet and of truncated domes, integral radius cut lines on back face of tile; with factory-applied removable protective sheeting.
 1. Material Properties:
 - a. Water Absorption: 0.20 percent, maximum, when tested in accordance with ASTM D570.
 - b. Slip Resistance: 0.50 minimum dry static coefficient of friction, when tested in accordance with ASTM D2047.
 - c. Compressive Strength: 25,000 pounds per square inch, minimum, when tested in accordance with ASTM D695.
 - d. Tensile Strength: 10,000 pounds per square inch, minimum, when tested in accordance with ASTM D638.
 - e. Flexural Strength: 25,000 pounds per square inch minimum, when tested in accordance with ASTM D790.
 - f. Chemical Stain Resistance: No reaction to 1 percent hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, or antifreeze, when tested in accordance with ASTM D543.
 - g. Abrasion Resistance: 300, minimum, when tested in accordance with ASTM C501.

- h. Flame Spread Index: 25, maximum, when tested in accordance with ASTM E84.
 - i. Accelerated Weathering: Delta-E of less than 5.0 at 2,000 hours exposure, when tested in accordance with ASTM G155.
 - j. Adhesion: No delamination of tile prior to board failure in a temperature range of 20 to 180 degrees F, when tested in accordance with ASTM C903.
 - k. Loading: No damage when tested according to AASHTO LRFD test method HS20.
 - l. Salt and Spray Performance: No deterioration or other defect after 200 hours of exposure, when tested in accordance with ASTM B117.
2. Installation Method: Cast in place.
 3. Shape: Rectangular.
 4. Size: As indicated on drawings.
 5. Dimensions: 24 inches by 48 inches.
 6. Pattern: In-line pattern of truncated domes complying with ADA Standards.
 7. Edge: Square.
 8. Joint: Butt.
 9. Color: SAE AMS-STD-595, Table IV, Federal Yellow No. 33538.

2.03 ACCESSORIES

- A. Adhesive: Type recommended and approved by surfacing tile manufacturer.
- B. Sealant: Elastomeric sealant of color to match adjacent surfaces; approved by surfacing tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. When installation location is near site boundary or property line, verify required location using property survey.
- B. Concrete to have a minimum compressive strength of 3,000 PSI
- C. Verify that work area is ready to receive work:
 1. Concrete has cured for 15 days prior to coating installation to insure proper bonding.
 2. If existing conditions are not as required to properly complete the work of this section, notify Architect.
 3. Do not proceed with installation until deficiencies in existing conditions have been corrected.
- D. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.02 PREPARATION

- A. Surface curing compounds or sealers shall be removed by method of grinding on any concrete that is less than 6 months old before coating products are installed.
- B. Surface finish should be medium broom finish for maximum adhesion.

3.03 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's written instructions.
 - 1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.
 - 2. Do not install when ambient or substrate temperature has been below 40 degrees F during the preceding 8 daylight hours.
- B. Field Adjustment:
 - 1. Locate relative to curb line in compliance with ATBCB PROWAG, Sections 304 and 305.
 - 2. Orient so dome pattern is aligned with the direction of ramp.
- C. Install units fully seated to substrate, square to straight edges and flat to required slope.

3.04 INSTALLATION, CAST IN PLACE PLASTIC TILES

- A. Tamp and vibrate units as recommended by manufacturer.
- B. Place and position weights on units while concrete cures as recommended by manufacturer. Ensure no voids or air pockets exist between top surface of concrete and underside of units.

3.05 CLEANING PLASTIC UNITS

- A. Remove protective plastic sheeting within 24 hours of installation.
- B. Remove excess sealant or adhesive from joints and edges.
- C. Clean four days prior to date of scheduled inspection.

3.06 PROTECTION

- A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.
- B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

END OF SECTION

**SECTION 32 3119
DECORATIVE METAL FENCES AND GATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Decorative Metal Fences and Gates.

1.02 RELATED SECTIONS

- 1. Section 32 12 16 – Asphalt Paving
- 2. Section 32 13 13 – Concrete Paving
- 3. Section 03 30 00 – Cast -in-Place Concrete
- 4. Section 31 20 00 – Earth Moving / Earth work for foundations and electrical distribution
- 5. Section 01 35 25 – Delegated Design Requirements
- 6. Section 26 05 13 Electrical Service and Connections

1.03 WORK PERFORMED BY OTHERS

- A. Design, provision, and installation of gate security access system including gate controllers, access control devices shall be by Others:
 - 1. Determine Owner requirements and provide complete design of gate security access system to satisfy all Owner, code and safety requirements.
 - 2. Determine and provide UL 325 rated gate controllers compatible with all aspects of the proposed gate and site conditions.
 - 3. Determine and install controllers at appropriate locations.
 - 4. Determine appropriate location of and provide engineered concrete pad for controllers including excavation as needed. Coordinate with Gate and Fence Installation.
 - 5. Design and provide appropriate anchoring of controllers to concrete pads.
 - 6. Design and determine appropriate and structurally sound mechanism for attaching Controller arm to gate without voiding warranty.
 - 7. Determine and install all Owner required controller accessories such as vehicle obstruction loop detectors and free exit loop detectors for complete and intended functioning of the gate.
 - 8. Determine and install external safety devices required for all safety and code compliance requirements.
 - 9. Provide and install Opticom devices if required.
 - 10. Determine appropriate location of mounting pole for Opticom Devices and providing complete design and installation of all components required to achieve a fully functional Emergency Access System.
 - 11. Wiring to all access control devices such as card readers, recorders, and controllers.

12. Coordinate all components of the Automatic Access Control and Emergency Access Control System with proposed gate and fence system for fully functional system as intended.
13. Integration of card readers and security system with Owner owned software and IT equipment.
14. Provide access control at Pedestrian Gates.
15. Provide Request to Exit button on exit side of Pedestrian Gate with Access Control. Pedestal mounted. Able to release electronic latch. Provide sign 'Press to Exit'. Orient button to prevent reach through activation from outside fence.
16. Provide Electronic Latch at Pedestrian Gate with Access Control suitable for exterior use. Able to secure gate in closed position. Fail open. Latch to release by signal from card reader or from request to exit button.
17. Preparation of submittals for Security Contractor work.
18. Review of submittals and coordination with work of General Contractor.

1.04 REFERENCES

- A. ASTM Testing Standards:
1. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.
 2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
 3. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
 4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
 5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.
 6. ASTM D 522 - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 7. ASTM D 523 - Standard Test Method for Specular Gloss.
 8. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 9. ASTM D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 10. ASTM D 3359 - Standard Test Methods for Measuring Adhesion by Tape Test.
 11. ASTM D 3363 - Standard Test Method for Film Hardness by Pencil Test.
 12. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016.
 13. ASTM G 155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

14. IBC Egress Requirements for appropriate classification and use
- B. ISO Testing Standards:
 1. ISO 1520 - Paints and Varnishes - Cupping Test.
 2. ISO 2815 - Paints and Varnishes - Buchholz Indentation Test.
- C. All Pedestrian and Vehicular Gates shall comply with Gated Access Standards and Vision Clearance Standards per City of Beaverton.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, and styles.
- B. Shop Drawings: Submit manufacturer's shop drawings, including schedule of components, plans and elevations indicating overall dimensions and layout. Provide foundation details, concrete design mix.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Product Certificates signed by manufacturers of fence and gates certifying products furnished comply with requirements.
- E. Warranty: Manufacturer's standard warranty.

1.06 QUALITY ASSURANCE

- A. Product Support: Products are supported with complete engineering drawings and design patents.
- B. Production: Schedule for production is order dependent.
- C. Facility Operator: Welders and machine operators are certified per AWS D1.1/D1.1M within the previous 12 months.
- D. Gate Panel Fabricator Qualifications:
 1. Minimum 3 years documented experience in automated gate panel fabrication in accordance with ASTM F 2200.
- E. Installer Qualifications:
 1. An installer, with minimum 5 years' experience, who has completed fences and gates similar in material, design, and extent to those specified for this Project and whose work has resulted in construction with a record of successful in-service performance.
- F. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate controllers serving as required means of Emergency Access.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- C. Handling: Protect materials and finish during handling and installation to prevent damage. Excessive damage to factory applied coatings will be cause for rejection.

1.08 WARRANTY

- A. Warranty Information:
 - 1. All structural fence components (i.e. rails, pickets, and posts) and gates shall be warranted within specified limitations, by the Manufacturer of original purchase for the duration covered under Manufacturer's standard warranty. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.
 - 2. Correct defective Work within a one-year period after Date of Substantial Completion.

1.09 PROJECT CONDITIONS:

- A. Existing utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under following conditions and the only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Resident Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Resident Engineer's written permission.
- B. Field measurements: Verify layout information and gates shown on Contract Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.01 FENCE TYPE I

- A. Manufacturer: Ameristar
- B. Series: Montage Plus
- C. Style: Majestic 4 rail puppy panel
- D. Bottom: Standard
- E. Color: Black.
- F. Height: 6 ft

- G. Length: See plan
- H. Material: Steel
- I. Typical Panel Length: Standard manufacturer panel length - Not to exceed 8 ft o.c.
- J. Top and Bottom Rails: 1.4375" x 1.5" x 14 ga Forerunner rails standard per Manufacturer.
- K. Pickets: 0.75" square x 18 ga. standard straight pickets per manufacturer.
- L. Picket Spacing: 4" standard picket airspace
- M. Fence posts: 2.5" x 16 ga standard per Manufacturer
- N. Fence Post Spacing: Not to exceed 8 ft o.c.
- O. Fence Post Cap: Standard flat cap
- P. Fence post footing: Provide complete engineered design of fence post structural footings
- Q. Fasteners: Provide appropriately rated and structurally adequate fasteners as needed.
- R. Brackets: Per manufacturer.
- S. Finish: Ameristar E-coat protective finish
- T. Fence Installation: Per Manufacturer instructions
- U. Touch up paint repair: Finishes and touch-up application on all cut components shall be per manufacturer recommendation for full warranty.

2.02 FENCE TYPE II

- A. Manufacturer: Ameristar
- B. Series: Echelon Plus
- C. Style: Majestic 3 rail panel
- D. Bottom: Standard
- E. Color: Black
- F. Height: 4'-0"
- G. Length: See plan
- H. Material: Aluminum
- I. Typical Panel Length: Standard manufacturer panel length - Not to exceed 8 ft o.c
- J. Components:
 - 1. Top and Bottom Rails: standard per Manufacturer
 - 2. Pickets: 0.75" square x 0.045" standard straight pickets per manufacturer.
 - 3. Picket Spacing: Standard 4" and 2" airspace per manufacturer for puppy panel
 - 4. Fence posts: Standard per Manufacturer for height specified
 - 5. Fence Post Spacing: Not to exceed 8 ft o.c
 - 6. Fence Post Cap: Standard flat cap
 - 7. Fence post footing: Provide complete engineered design of fence post structural footings
 - 8. Fasteners: Provide appropriately rated and structurally adequate fasteners as needed.

- 9. Brackets: Per manufacturer.
- K. Finish: Manufacturer standard six-stage pretreatment/ wash followed by electrostatic spray application of a no-mar TGIC polyester powder coat finish with min. 2-4 mils thickness, color black.
- L. Fence Installation: Per Manufacturer instructions
- M. Touch up paint repair: Finishes and touch-up application on all cut components shall be per manufacturer recommendation for full warranty.

2.03 GATE TYPE I

A. PEDESTRIAN SINGLE SWING GATE WITH STRAIGHT PICKETS

- 1. Manufacturer: Ameristar.
- 2. Series: Montage Plus 3 rail style
- 3. Height: 6 ft.
- 4. Opening Width: 4 ft
- 5. Gate Leaf Width: Appropriate for opening per Manufacturer.
- 6. Material: Steel
- 7. Swing Direction: Per plan.
- 8. Color: Black.
- 9. Components:
 - a. Top and Bottom Rails: 1.75" x 14 ga standard per Manufacturer.
 - b. Gate Ends: 1.75" sq. X 14 ga. standard per manufacturer.
 - c. Pickets: Standard straight 0.75" sq. x 18 ga pickets per Manufacturer.
 - d. Picket Spacing: Standard per Manufacturer. Picket spacing shall not exceed 4" o.c.
 - e. Gate Post: 2.5" x 14 ga. standard per manufacturer for height and gate leaf specified.
 - f. Gate post cap: Standard flat cap
 - g. Gate Post spacing: Per Manufacturer appropriate for gate leaf.
 - h. Gate Post Footing: Provide complete engineered design of gate post footing.
 - i. Gate bottom: Standard bottom per Manufacturer.
 - j. Hinges: Manufacturer's standard Hinges - heavy duty, gravity type self-closing, structurally adequate for application, capable of operation without binding. Non-lift-off type hinge design shall permit gate to swing 180° (degrees). Hinge pins shall be non-removable. Opening force required for gate shall comply with limits of American with Disabilities Act (ADA).
 - k. Hinge clearance: Per Manufacturer recommendation.
 - l. Latch Clearance: Per Manufacturer recommendation.

- m. Gate Hardware: Manufacturer's standard hardware as required for complete functional and intended operation. Install per Manufacturer recommendations.
 - 1) Install molded rubber bumper pad contact dampener
- n. Fasteners: Per Manufacturer. Heavy duty, exterior rated, tamper proof and appropriate for application.
- o. Panic control devices:
 - 1) Gate to be prepped to receive panic hardware
 - 2) Panic Plate: Per manufacturer
 - (a) Plate Installation: Per manufacturer
 - (b) Color: Black
 - (c) Finish: To match gate
 - 3) Panic Hardware: Per Architect. See Door hardware specifications.
- p. Kick Plate: Per manufacturer – gate to be prepped with kick plate.
 - 1) Install on push side
 - 2) Color: Black
 - 3) Finish: To match gate
- 10. Touch up paint repair: Finishes and touch-up application on all cut components shall be per manufacturer recommendation for full warranty.
- 11. Access control devices: Per Architect

2.04 GATE TYPE II

A. PEDESTRIAN SINGLE SWING POOL GATE

- 1. Manufacturer: Ameristar.
- 2. Series: Montage Plus Majestic Pool gate 3 rail style
- 3. Height: 6 ft.
- 4. Opening Width: 4 ft
- 5. Gate Leaf Width: Appropriate for opening per Manufacturer.
- 6. Material: Steel
- 7. Swing Direction: Per plan.
- 8. Color: Black.
- 9. Components:
 - a. Top and Bottom Rails: 1.75" x 14 ga standard per Manufacturer.
 - b. Gate Ends: 1.75" sq. X 14 ga. standard per manufacturer.
 - c. Pickets: Standard straight 0.75" sq. x 18 ga pickets per Manufacturer.
 - d. Picket Spacing: Standard per Manufacturer. Picket spacing shall not exceed 4" o.c.
 - e. Gate Post: 2.5" x 14 ga. standard per manufacturer for height and gate leaf specified.
 - f. Gate post cap: Standard flat cap

- g. Gate Post spacing: Per Manufacturer appropriate for gate leaf.
- h. Gate Post Footing: Provide complete engineered design of gate post footing.
- i. Gate bottom: Standard bottom per Manufacturer.
- j. Hinges: Manufacturer's standard Hinges - heavy duty, gravity type self-closing, structurally adequate for application, capable of operation without binding. Non-lift-off type hinge design shall permit gate to swing 180° (degrees). Hinge pins shall be non-removable. Opening force required for gate shall comply with limits of American with Disabilities Act (ADA).
- k. Hinge clearance: Per Manufacturer recommendation.
- l. Latch Clearance: Per Manufacturer recommendation.
- m. Latch: Self closing gate latch for pools. In compliance with Oregon Health Authority Rules for pool enclosures, provide a lockable, self-latching device.
- n. Gate Hardware: Manufacturer's standard hardware as required for complete functional and intended operation. Install per Manufacturer recommendations.
 - 1) Install molded rubber bumper pad contact dampener
- o. Fasteners: Per Manufacturer. Heavy duty, exterior rated, tamper proof and appropriate for application.
- p. Panic control devices:
 - 1) Gate to be prepped to receive panic hardware
 - 2) Panic Plate: Per manufacturer
 - (a) Plate Installation: Per manufacturer
 - (b) Color: Black
 - (c) Finish: To match gate
 - 3) Panic Hardware: Per Architect. See Door hardware specifications.
- q. Kick Plate: Per manufacturer – gate to be prepped with kick plate.
 - 1) Install on push side
 - 2) Color: Black
 - 3) Finish: To match gate
- 10. Touch up paint repair: Finishes and touch-up application on all cut components shall be per manufacturer recommendation for full warranty.
- 11. Access control devices: Per Architect
 - a. Mounting Height: Per Architect

2.05 GATE TYPE III:

- A. Pedestrian Single Swing Gate
 - 1. Manufacturer: Ameristar.
 - 2. Series: Echelon Plus Majestic Puppy
 - 3. Model: 4 rail single swing puppy gate

4. Height: 4 ft.
5. Opening Width: 4 ft
6. Gate Leaf Width: Appropriate for opening per Manufacturer.
7. Material: Aluminum
8. Swing Direction: Per plan.
9. Color: Black.
10. Components:
 - a. Top and Bottom Rails: 1.75" x 14 ga standard per Manufacturer.
 - b. Gate Ends: 1.75" sq. X 14 ga. standard per manufacturer.
 - c. Pickets: Standard per Manufacturer.
 - d. Picket Spacing: Standard per Manufacturer.
 - e. Gate Post: 2.5" x 2.5" x 0.06 Aluminum standard per manufacturer for height and gate leaf specified.
 - f. Gate post cap: Standard flat cap
 - g. Gate Post spacing: Per Manufacturer appropriate for gate leaf.
 - h. Gate Post Footing: Provide complete engineered design of gate post footing.
 - i. Gate bottom: Standard bottom per Manufacturer.
 - j. Hinges: Manufacturer's standard Hinges - heavy duty, gravity type self-closing, structurally adequate for application, capable of operation without binding. Non-lift-off type hinge design shall permit gate to swing 180° (degrees). Hinge pins shall be non-removable. Opening force required for gate shall comply with limits of American with Disabilities Act (ADA).
 - k. Hinge clearance: Per Manufacturer recommendation.
 - l. Latch Clearance: Per Manufacturer recommendation.
 - m. Gate Hardware: Manufacturer's standard hardware as required for complete functional and intended operation. Install per Manufacturer recommendations.
 - 1) Install molded rubber bumper pad contact dampener
 - n. Fasteners: Per Manufacturer. Heavy duty, exterior rated, tamper proof and appropriate for application.
 - o. Fasteners: Per Manufacturer. Heavy duty, exterior rated, tamper proof and appropriate for application.
 - p. Panic control devices:
 - 1) Gate to be prepped to receive panic hardware
 - 2) Panic Plate: Per manufacturer
 - (a) Plate Installation: Per manufacturer
 - (b) Color: Black
 - (c) Finish: To match gate
 - 3) Panic Hardware: Per Architect. See Door hardware specifications.

- q. Kick Plate: Per manufacturer – gate to be prepped with kick plate.
 - 1) Install on push side
 - 2) Color: Black
 - 3) Finish: To match gate
- 11. Touch up paint repair: Finishes and touch-up application on all cut components shall be per manufacturer recommendation for full warranty.
- 12. Access control devices: Per Architect
 - a. Mounting Height: Per Architect

2.06 VEHICULAR GATES:

- A. VEHICULAR GATE TYPE I:
 - 1. Automated vehicular bi-parting roll gate.
 - 2. Manufacturer: Ameristar or approved equal.
 - 3. Series: Passport Commercial.
 - 4. Height: 6 ft.
 - 5. Weight per gate leaf: Standard per Manufacturer prior to addition of any screening/ accessories. Verify prior to installation.
 - 6. Direction of gate travel to the open position viewing from outside fence line looking in: one leaf left opening and one leaf right opening, per plan.
 - 7. Gate Post: Per Manufacturer's 4" square x 11 ga. steel tube with Manufacturer's cap.
 - 8. Material: Steel Per manufacturer of minimum yield strength 45,000 psi
 - 9. Color: Black.
 - 10. Components:
 - a. Gate Uprights: Standard 2" x 12 ga. steel per Manufacturer.
 - b. Pickets: Standard 3/4" sq. x 14 ga steel pickets standard per manufacturer for gate systems of less than 22 ft opening. Securely fasten pickets to top and bottom tracks per Manufacturer instructions.
 - c. Picket Spacing: Standard per Manufacturer. Not to exceed 4" o.c.
 - d. Diagonal, top rails: Standard 2" sq x 12 ga. per Manufacturer.
 - e. Bottom rail: 2"x4" x 11 ga. standard per manufacturer.
 - f. Gate Post locations: Determine appropriate gate posts locations and install gate posts.
 - 11. Optional safety kit for automated gates:
 - a. Per Manufacturer.
 - b. To be included.
 - c. Install per Manufacturer recommendations.
 - 12. Screening kit:
 - a. Per Manufacturer.

- b. To be included.
- c. Fasten mesh with tamper-proof fasteners.
- 13. Assembly and Installation: Per Manufacturer instructions.
- 14. Gate Hardware:
 - a. All required per Manufacturer recommendations.
 - b. Installation: Per Manufacturer' **instructions**.
 - c. Any gate hardware incompatible with controller or automated functioning of the gate such as, but not limited to, manual locking hardware, shall not be installed.
- 15. Access Control devices: Per Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive work, with Installer present. Verify that field conditions are acceptable and ready to receive work and in compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.
- D. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

3.02 INSTALLATION

- A. GATE INSTALLATION:
 - 1. Install items in accordance with manufacturer's instructions at locations indicated on the Drawings.
 - 2. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference.
 - 3. Attach any hardware using tamper-resistant or concealed means.
 - 4. Coordinate all post and footings with below ground utilities.
 - 5. Coordinate all footings and pads with civil and adjacent grade, proposed and existing conditions.
- B. FENCE INSTALLATION:
 - 1. Install fences according to manufacturer's written instructions.
 - 2. Post Excavation:
 - a. Drill or hand excavate as needed, holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times the post size and a depth of not less than 36 inches.
 - 3. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

- a. Verify that posts are set plumb, aligned and at correct height and spacing and hold in position during setting with concrete
- b. Concrete Fill:
 - 1) Place concrete around post's and vibrate or tamp for consolidation. Protect above ground portion of posts from concrete splatter
 - 2) Concealed concrete: Slope top surface of concrete to drain water away from post. Allow sufficient depth below grade to allow for adequate covering with surface material.
4. Install items plumb and level, accurately fitted and free from distortion or defects.
5. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
6. Any field welding shall be in accordance with AWS D1.1/D1.1 M.
7. Obtain approval prior to site cutting or making adjustments not scheduled.
8. After erection, prime welds, abrasions and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete with manufacturer approved coatings.

3.03 TOLERANCES

- A. Maximum variation at vertical elements: 1/4 inch in any direction for 30 feet
- B. Maximum Deviation from Plumbness of vertical and horizontal elements of Gates: 3/8 inch in 10 feet
- C. Maximum Offset from True Alignment: 1/4 inch
- D. Maximum Out-of-Position: 1/4 inch

3.04 ADJUSTING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.
- C. Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.
- D. Confirm that latches and locks engage accurately and securely without forcing or binding.
- E. Lubricate hardware and other moving parts for smooth functioning of gates as intended.

3.05 CLEANING

- A. Clean panels promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.06 PROTECTION

- A. Protect installed panels to ensure that, except for normal weathering, units will be without damage or deterioration at time of Substantial Completion.
- B. If minor damage occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect/ Owner's Representative.

END OF SECTION

**SECTION 32 33 00
SITE FURNISHINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Synthetic Turf Type I
- B. Synthetic Turf Type II
- C. Specialty Surfacing Type I
- D. Bench Type I
- E. Bench Type II
- F. Bench Type III
- G. Concrete Seat wall Type I
- H. BBQ Grill Unit with task lights
- I. Tree Grate
- J. Fire Table
- K. Pool Bar
- L. Light Type I
- M. Light Type II
- N. Bike Rack
- O. Trash Receptacle

1.02 RELATED DOCUMENTS

- A. Section 05 05 00 - Metal Fabrications Plants - Section 32 93 00
- B. See section 09 96 00 – High Performance Coatings
- C. See section 03 35 00 – Concrete Finishing for board form concrete

1.03 REFERENCE STANDARDS

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.
- C. Shop Drawings: Indicate plans for each unit or group of units, elevations with model number, overall dimensions, construction, and anchorage details.
- D. Samples: Submit two sets of manufacturer's available colors for metal furnishings.

- E. Samples: Submit two sets of manufacturer's available colors and finishes for precast furnishings.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 SYNTHETIC TURF TYPE I

- A. Manufacture: Forever Lawn
- B. Series: Landscape Grass
- C. Color: TBD
- D. Quantity: Per Plan

2.02 SYNTHETIC TURF TYPE II

- A. Manufacturer: Forever Lawn
- B. Series: K9 Grass System
- C. Color: TBD
- D. Quantity: Per Plan

2.03 SPECIALTY SURFACING

- A. Manufacturer: Thermory USA
- B. Series: Benchmark Ash Decking Standard Stock
- C. Size: 2 x 6
- D. Length: TBD
- E. Finish Stain: TBD
- F. Base: Concrete Rat Slab

2.04 BENCH TYPE I

- A. Manufacturer: Columbia Cascade
- B. Series: TimberForm Parkway Bench with Back
- C. Model: 2016-6-E (wood slats)
- D. Length: 5'-0"
- E. Mounting: Direct Embedment
- F. Frame Color: Powder coated black steel

2.05 BENCH TYPE II

- A. Manufacturer: Columbia Cascade
- B. Series: TimberForm Parkway bench with back
- C. Model: 2016-6-NYCSCA Bench (Ipe Slats)
- D. Length: 5'-0"
- E. Mounting: Pedestal/ Surface Mounting
- F. Anchoring Hardware: Stainless Steel

- G. Frame: Black powder coated steel

2.06 BENCH TYPE III

- A. Manufacturer: Columbia Cascade
- B. Series: TimeberForm Parkway Bench with back
- C. Model: 2016-6-NYSCA-ADA
- D. Length: 6'-0"
- E. Mounting: Pedestal/ Surface Mounting
- F. Anchoring hardware: Stainless steel
- G. Frame: Black powder coated steel

2.07 CONCRETE SEAT WALL TYPE I

- A. Cast-in-place concrete seat wall
- B. Width: 18"
- C. Height: 18"
- D. Length: Per plan
- E. Finish: Board form concrete

2.08 BAR-BE-QUE GRILL ISLAND

- A. Installer/ designer: Grillworks PDX
 - 1. Contact:
 - a. Andy Black
 - b. Address: Grillworks Supply Company Co., 3850 SW Hall Blvd., Beaverton, OR 97005
 - c. Email: andy@grillworkspdx.com
 - B. Frame: Steel
 - C. Countertop: TBD
 - D. Cladding:
 - 1. Material: Thermory Ash Standard Stock
 - 2. Length: Per plan
 - 3. Size: 1 x 4 Ash Standard Stock
 - E. Grill:
 - 1. Manufacturer: Delta Heat
 - 2. Model: 32" Outdoor gas grill DHBQ-32-R-DN with rotisserie
 - 3. Fuel: Natural Gas
 - 4. Size: 32"

2.09 TREE GRATE

- A. Manufacturer: Urban Accessories
- B. Model: Jamison 2000
- C. Size: 4 ft x 4 ft square
- D. Materials: Cast Iron

- E. Finish: Raw with rust conditioner

2.10 FIRE TABLE

- A. Manufacturer: Paloform
- B. Model: Robata Concrete Linear Fire Pit with tempered glass screen.
- C. Material: Charcoal concrete and black powder-coat stainless steel
- D. Size: 72" x 24" x 12.5" (height)
- E. Ignition: Electronic ignition
- F. Burners: Natural Gas
- G. Accessories: All-weather cover to be included
- H. Topping: Dark grey River Rock

2.11 POOL BAR:

- A. Frame:
 - 1. Material: Powder coated HSS or light gauge galvanized steel
 - 2. Height: 30" from FFE
- B. Cladding:
 - 1. Material: Thermory USA Cladding
 - 2. Series: Standard Ash Cladding Stock
 - 3. Size: 1 x 4 Standard Ash stock
 - 4. Length: Per plan

2.12 LIGHT TYPE I

- A. Manufacturer: FX Luminaire
- B. Model: M-PJ
- C. Finish: FB Black
- D. Material: Die cast Aluminum
- E. Input voltage: 10-15 V

2.13 LIGHT TYPE II

- A. Manufacturer: FX Luminaire
- B. Model: FB LED Uplight
- C. Finish: FB Black
- D. Material: Die cast Aluminum

2.14 BIKE RACK

- A. Manufacturer: Huntco
- B. Model: The Burnside
- C. Dimensions: 28" length, 6" width, 33.4" height
- D. Mounting: Flange Mount
- E. Mounting Hardware: Stainless steel anchor bolts of appropriate size for 0.4" mounting holes

- F. Frame: Outer – 2" x 1" stainless steel rectangular tubing; Inner bar - .25" x 2" stainless steel flat bar; bumper – santoprene TPV; flanges – 2" x 6" stainless steel
- G. Finish: Stainless steel bead blast finish

2.15 TRASH RECEPTACLE

- A. Manufacturer: Huntco
- B. Model: Sherwood
- C. Size: 32 gallon
- D. Material: Perforated and Solid sheet steel
- E. Overall dimensions: 26" diameter and 36" height
- F. Mounting option: Flange mount
- G. Hardware: Provide appropriate galvanized or stainless steel anchors, 3 per receptacle
- H. Lid: Dome with ash insert
- I. Liner: 32-gallon liner
- J. Security cable for lid: To be included
- K. Decorative options: Standard circles
- L. Finish: Powder coated black

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify proper installation of mounting surfaces, preinstalled anchor bolts, and other mounting devices; and ready to receive site furnishing items.
- B. See Section 05 50 00 for anchors to attach site furnishings to mounting surfaces.
- C. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

- A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.
- B. Provide level mounting surfaces for site furnishing items.

END OF SECTION

32 40 00
Landscape Boulder

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes site stonework to be approved on site by the Landscape Architect:
 - 1. Decorative Stone - Type I.
 - 2. Landscape Boulder

1.02 RELATED SECTIONS

- A. Division 1 - Administrative requirements
- B. Division 1 - Closeout submittals and procedures

1.03 PERFORMANCE REQUIREMENTS

- A. General: provide to the site and hand set stonework in conformance with the drawings and under the direction of the Landscape Architect.

1.04 SUBMITTALS

- A. General: submit the following in accordance with Division One.
 - 1. Product data for each type of landscape stone to be furnished.
 - 2. Representative photos of proposed landscape stone to be imported to the site.
 - 3. Sample delivered to the site for verification purposes of stone in form for each color, grade, finish, type and variety of stone required. Include 2 or more stones in each set of samples showing the full range of variations in appearance characteristics to be expected in the completed work.

1.05 QUALITY ASSURANCE

- A. Single-source responsibility for landscape stone: obtain landscape stone from a single source with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to cut and finish the material without delaying the progress of the work.
- B. Information on the drawings and in the specifications establishes the requirements for both aesthetic effects and performance of the landscape stone. Aesthetic effects relative to the formal characteristics are indicated by dimensions, arrangement, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction; performance is indicated by criteria subject to verification either by preconstruction or field test, if applicable, or by in-service experience.
- C. Do not modify intended aesthetic effects, except with the Landscape Architect's approval, and only to the extent exclusively needed to comply with the performance requirements. Where modifications are proposed, submit comprehensive explanatory data for review.
- D. Mock-ups: on-site mock-ups are required for the following. Accepted mock-ups can be incorporated into finished work.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the project site in undamaged condition.
- B. Store and handle the landscape stone and related materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breakage, chipping, or other causes.
- C. Do not use pinch or wrecking bars.

PART 2 PRODUCTS

2.01 LANDSCAPE BOULDER

- A. Size: 1/2 to 1 ton, 18-24 inches above grade, average dimension 24 - 42 inches approximate length/width (top surface area). Boulders less than 3 cubic feet in volume shall not be used.
- B. Supplier: Pacific Stonescape, Inc.
- C. Type: Molalla Boulders or Idaho Mt. Boulders
- D. Quantity: per plan
- E. Installation: per detail

EXECUTION

- A. EXAMINATION
- B. Examine the surfaces to receive the stonework, and the conditions under which the stonework will be installed, with the Installer present, for compliance with the requirements for installation and other conditions affecting the performance of the stonework. Do not proceed with installation until unsatisfactory conditions have been corrected
- C. PREPARATION
- D. Protect the stonework during erection as follows:
 - 1. Prevent staining of the landscape stone from caulking or paving materials. Immediately remove such materials from the landscape stone without damage to the latter.
 - 2. Protect projections from droppings of sealants or other construction materials or damage from construction machines.
 - 3. Clean landscape stone surfaces that have become dirty and stained prior to setting to remove soil, stains, and foreign materials. Clean landscape stone by thoroughly scrubbing landscape stone with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh filler or abrasives.
 - 4. Do not damage plaques, inscriptions relief or moss.

3.02 SETTING LANDSCAPE STONE, GENERAL

- A. Placement, location and orientation of all landscape stone shall be approved by the Landscape Architect.

- B. Placement of landscape stone: execute the stonework by skilled mechanics with equipment and expertise to run equipment needed to move and set large landscape stone.
- C. Placement general: set the landscape stone to comply with the requirements indicated on the drawings. Shim and adjust to set the landscape stone accurately in the locations indicated with joints of widths and with edges and faces aligned according to the established relationships and indicated tolerances.

3.03 BROKEN, CHIPPED, STAINED, OR OTHERWISE DAMAGED STONES

- A. Broken, chipped, stained, or otherwise damaged stone may be replaced until the methods and results are acceptable to the Landscape Architect.
 - 1. Stones and joints not matching the approved samples.
 - 2. Stonework not complying with other requirements indicated.
- B. Replace in a manner that results in the stonework matching the approved samples, complying with other requirements, and showing no evidence of replacement.
- C. Clean the stonework not less than 2 days after completion of the work, using clean water and stiff bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage the stone.
- D. Do not damage plaques, relief feature, name inscriptions, or moss, etc.

3.04 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Owner. Ensure the stonework has no damage or deterioration at the time of substantial completion.

END OF SECTION

SECTION 32 84 00
IRRIGATION

GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Piping
 - 2. Automatic Controller
 - 3. Controller Accessories
 - 4. Flow Sensor
 - 5. Electrical
 - 6. Low Voltage Wiring
 - 7. Tracer Wiring / Marking Tape
 - 8. Manual Control Valves
 - 9. Master Valve
 - 10. Automatic Control Valves
 - 11. Valve Boxes
 - 12. Valve Tags
 - 13. Irrigation Heads and Nozzles
 - 14. Drip Equipment
- B. Related Sections
 - 1. Section 32 91 00 - Soil Preparation

1.03 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves, piping is under pressure during flow.
- B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
- C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.04 CONSTRUCTION DRAWINGS

- A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally

diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.

- B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.
- C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.05 QUALITY ASSURANCE

- A. Irrigation contractor/installer: Must be required to be a Washington state licensed landscape contractor with a minimum of 5 years documented experience in irrigation installation of a similar nature, (Consultant to define enforcement of this clause for each project.)
- B. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.
- C. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnishes directions covering points not shown in the drawings and specifications.
- D. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.
- E. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to Owner.
- F. The Contractor shall secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.
- G. The work is subject to tests and inspections by the School District as specified. Furnish written notice to the School District one week prior to the required test or inspection.

1.06 SYSTEM DESCRIPTION

- A. The sprinkler irrigation system shall be constructed using spray heads, valves, piping, fittings, controllers, wiring and the like, of sizes and types as called for in these specifications and as indicated on the irrigation plans. The system shall be constructed to grades and conform to the site landscape plan.

1.07 SUBMITTALS

- A. Materials List:
1. After award of contract and before any irrigation system materials are delivered to the job site, submit to the Owner a complete list of all irrigation systems, materials, or processes proposed to be furnished and installed as part of this contract.
 2. Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data; furnish the manufacturer's recommendations as to the method of installation.
 3. No substitutions will be allowed without prior written acceptance by the Landscape Architect or Owner's authorized representative.
 4. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
 - a. Substitutions:
 5. If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or Owner's authorized representative for approval.
 6. Provide a written statement indicating the reason for making the substitution.
 7. Provide catalog cut sheets, technical data, and performance information for each substitute item.
 8. Provide in writing the difference in installed price if the item is accepted.

1.08 EXISTING CONDITION

- A. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water, and electrical supply.
- B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and Owner's authorized representative prior to beginning construction.
- C. Prior to cutting into the soil, the Contractor shall locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground, and he shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and Owner who will arrange for re-location.
- D. The Contractor will proceed in the same manner if a solid rock obstruction or any other such conditions are encountered.

- E. The Contractor shall protect all existing utilities and features to remain on an adjacent to the project
- F. Site during construction. Contractor shall repair, at his own cost, all damage resulting from his operations or negligence.
- G. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeves as shown on the plans.

1.09 CONSTRUCTION OBSERVATIONS

- A. The Contractor shall permit the Landscape Architect and Owner's authorized representative to visit and review at all times any part of the work and shall provide safe access for such visits.
- B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, Owner's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.
- C. Reviews will be required for the following at a minimum:
 - 1. Pressure test of irrigation main line (One hour at 125 PSI or 120% of static water pressure, whichever is greater.)
 - 2. Coverage test of irrigation system prior to installation of plant material.
 - 3. Substantial Completion Punch List shall be conducted when Contractor has completed all portions of the work and prior to start of maintenance period. Contractor shall provide progress Record Drawings for review by Landscape Architect.
 - 4. Substantial Completion Punch List Follow-up shall be conducted within three weeks of initial punch list to confirm 100% completion of work Provide completed Record Drawings.
 - 5. Post Maintenance Final Acceptance shall be conducted at the end of the Maintenance Period.
 - 6. Site observations and testing will not commence without the record drawings as prepared by the Irrigation Contractor. Record drawings must complete and up to date for each site visit.
 - 7. Work which fails testing and is not accepted will be re-tested. Hourly rates and expenses of the Landscape Architect, Owner's authorized representative, and governing agencies for re-observations or re-testing will be paid by the Irrigation Contractor at no additional expense to Owner.

1.10 STORAGE AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and Owner and at no additional cost to the Owner.

- B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.11 CLEANUP AND DISPOSAL

- A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site.
- B. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals or when ordered to do so by the Owner's authorized representative.
- C. At the time of completion, the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.12 TURNOVER ITEMS

- A. Record Drawings:
 - 1. Record accurately on one set of contract drawings all changes in the work constituting departures from the original contract drawings.
 - 2. The changes and dimensions shall be recorded in a legible and workmanlike manner to the satisfaction of the owner. Prior to final observation of work, submit record drawings to the Landscape Architect or Owner's authorized representative.
 - 3. Dimensions from/to permanent points of reference such as buildings, sidewalks, curbs, etc., shall be shown. Data on record drawings shall be recorded on a day to day basis as the project is being installed. All lettering on drawings shall be minimum 1/8 inch in size.
 - 4. Show locations and depths of the following items:
 - a. Point of connection (including water POC, master control valves, quick couplers, etc.)
 - b. Routing of sprinkler pressure lines (dimensions shown at a maximum of 100 feet along routing)
 - c. Isolation valves
 - d. Automatic remote control valves
 - e. Quick coupling valves
 - f. Routing of control wires
 - g. Irrigation controllers
 - h. Related equipment (as may be directed)
 - 5. Maintain record drawings on site at all times. Upon completion of work, transfer all as-built information and dimensions to reproducible prints.
- B. Controller Charts:
 - 1. Record drawings must be approved by Landscape Architect and/or Owner's authorized representative before charts are prepared.
 - 2. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller.

3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
 4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.
- C. Operation and Maintenance Manuals:
1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or Owner's authorized representative at least 10 calendar days prior to final observations. The manuals shall describe the material installed and the proper operation of the system.
- D. Each complete, bound manual shall include the following information:
1. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
 2. Guarantee/warranty certificates for all equipment used and Contractor's written warranty for entire system one (1) year guarantee.
 3. Operating and maintenance instructions for all equipment.
 4. Spare parts list and related manufacturer information for all equipment.
 5. Equipment:
 6. Supply as a part of this contract the following items:
 7. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head used in the irrigation system.
 8. Three 30-inch sprinkler keys for manual operation of control valves.
 9. Two keys for each automatic controller.
 10. Two quick coupler keys with a 1" bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
 11. One valve box cover key or wrench.
 12. Six extra sprinkler heads of each size and type.
 13. The above equipment shall be turned over to Owner's authorized representative at the final observation.

1.13 COMPLETION:

- A. At the time of the Substantial Completion Punch List Observation, the Landscape Architect, Owner's authorized representative, and governing agencies will observe the work and prepare a list of items to be completed by the Contractor. If deemed in Substantial Completion the Contractor will be directed to begin the Maintenance Period.
- B. Within three (3) weeks of the Substantial Completion Observation a Follow-up Observation will be made to confirm 100% completion of all Punch List items
- C. At the end of the Maintenance Period the work will be reviewed and if deemed in conformance with the Construction Documents a Final Acceptance will be prepared in writing by the Landscape Architect, Owner's authorized representative, and governing agencies

- D. The Owner's authorized representative shall have final authority on all portions of the work.
- E. After the system has been completed, the Contractor shall instruct Owner's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.
- F. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the owner's satisfaction by the Contractor without any additional expense to the owner. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.14 GUARANTEE

- A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.
- B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to owner within three (3) calendar days of receipt of written notice from Owner. When the nature of the repairs as determined by the Owner constitute an emergency (i.e. broken pressure line) the Owner may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the owner by the Contractor, all at no additional cost to the Owner.
- C. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.
- D. Guarantee shall be submitted on Contractors own letterhead as follows:
 - 1. GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM
 - 2. We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the owner. We shall make such repairs or re-placements within 10 calendar days following written notification by the owner. In the event of our failure to make such repairs or replacements within the time specified af-ter receipt of written notice from owner, we authorize the owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.
 - 3. PROJECT NAME:
 - 4. PROJECT LOCATION:
 - 5. CONTRACTOR NAME:
 - 6. ADDRESS:

7. TELEPHONE:
8. SIGNED:
9. DATE:

PRODUCTS

2.01 SUMMARY

- A. Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, Owner's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the Owner.
- B. PIPING
 1. Pressure supply lines larger than 4 inches in diameter downstream of backflow prevention unit shall be Class 200 solvent weld PVC. Piping shall conform to ASTM D2241.
 2. Pressure supply lines up to 4 inches in diameter and smaller downstream of the backflow prevention unit shall be PVC Schedule 40 solvent weld PVC conforming to ASTM D1785. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be PVC Schedule 40 solvent weld PVC conforming to ASTM D2241.
 3. All PVC pipe shall be marked with the manufacturer's name, class of pipe and NSF seal. Pipe shall bear no evidence of interior or exterior extrusion marks. Pipe walls shall be uniform, smooth and glossy. Pipe may be pre-belled or with individual solvent-weld couplings.
 4. All PVC fittings shall be of the solvent weld type except where risers, valves, etc., require threaded transition fittings. All fittings shall conform to the requirements of ASTM D2466-78. All threaded PVC fittings and nipples shall be Schedule 80.
 5. All PVC pipe must be delivered in at least twenty foot (20') lengths.
 6. All PVC pipes and fittings for swing joints shall conform to all requirements of ASTM D31 39.
 7. Sleeves required for main and lateral lines located under paving shall be Schedule 40 PVC, with the inside diameter (I.D.) of sleeve to be twice the outside diameter (O.D.) of the insert pipe, maximum 1 insert pipe per sleeve.
 8. Use Teflon tape on all threaded fittings.

2.02 AUTOMATIC CONTROLLER

- A. Per Plan

2.03 CONTROLLER ACCESSORIES

- A. Per Plan

2.04 FLOW SENSOR

- A. Per Plan

2.05 ELECTRICAL

- A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.
- B. All electrical work shall conform to local codes and ordinances.

2.06 LOW VOLTAGE CONTROL WIRING

- A. Control wire shall be compatible with controller and recommended by controller manufacturer.
 - 1. Number 14-size copper wire approved for underground direct burial.
 - a. Connections shall be either epoxy-sealed packet type or Penn-Tite connectors.
- B. Communications Wire
 - 1. Per Plan
 - a. Connections shall be either epoxy-sealed packet type or Penn-Tite connectors.

2.07 TRACER WIRE / MARKING TAPE

- A. Tracer wire shall be blue coated 14-gauge wire.
- B. Trace tape shall be 5.0 mil 100% virgin polyethylene, acid, alkaline and corrosion resistant, with 2.0 mil solid aluminum foil core encapsulated within a polyethylene (2.55 mil) backing.
 - 1. Blue color used for potable water, tape Model No. TA-DT-3(6)-BI to read: "CAUTION IRRIGATION LINE BELOW".
 - 2. Purple color used with non-potable water or recycled/reclaimed water, tape Model No. TA-DT-3-PRW to read: "CAUTION RECYCLED / RECLAIMED WATER LIN BELOW".
 - 3. Use 3" wide tape on all lines 4" and smaller.
 - 4. Use 6" wide tape on all lines 6" and larger.
 - 5. Tape shall be as manufactured by T. Christy Enterprises (800) 258-4583 or Architect's approved equal. Install as per manufacturer instructions and recommendations.

2.08 MANUAL CONTROL VALVES

- A. Gate Valves:
 - 1. Gate valves shall be constructed of a bronze body, stainless steel ball and stem.
 - 2. Gate valves shall have threaded connections.
 - 3. All gate valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.
- B. Ball valves under 2.5 inches:
 - 1. True union ball valves
 - 2. Schedule 80
 - 3. All ball valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.
- C. Quick Coupler Valves:
 - 1. Model: As indicated on the drawings.
 - 2. Include 1 matching key and swivel hose elbow.
 - 3. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 1" female

threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.

2.09 BACKFLOW PREVENTION ASSEMBLY

- A. Wye strainers at backflow prevention units shall have a bronzed screwed body with 60 mesh stainless steel screen and shall be similar to the Wilkins model S series, or approved equal.
- B. Model: As indicated on the drawings
- C. Contractor in all projects shall install the backflow assembly housing in a vault below grade unless informed by the Landscape Architect.
- D. In such project that the backflow assembly housing is installed above grade the assembly shall be installed in a Hot Box.
 - 1. Backflow prevention assembly shall be installed within locking security enclosures.
 - a. Enclosure by Safe-T-Cover
 - b. Models: 200D-AL and 300D-AL
 - 2. The backflow prevention assembly enclosure shall require a backflow enclosure mounting pad. Provide each enclosure with a prefabricated mounting pad and support base.

2.10 MASTER VALVE

- A. Per Plan

2.11 AUTOMATIC CONTROL VALVES:

- A. Per Plan

2.12 VALVE BOXES

- A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.
- B. The valve box cover shall be black in color and secured with a hidden latch mechanism or bolts. Rain Bird VB-XXXX-BBKL or approved equal.
- C. The cover and box shall be capable of sustaining a load of 1,500 pounds.
- D. Valve box extensions shall be by the same manufacturer as the valve box.
- E. Automatic control valve boxes shall be 16"x11"x12" rectangular size.
- F. Valve boxes for backflow device, water meter, and shutoff valves shall be traffic rated to a carrying a load of 8,000 pounds.
 - 1. Carson Heavy Wall 1730 or approved equal
 - 2. Carson HD Plastic Lid or approved equal
 - a. Valve box covers shall be marked "RCV"
 - b. Ball valve and quick coupler valve boxes shall be 10" diameter circular size. Valve box covers shall be marked with either "BV" or "QCV"

2.13 VALVE TAGS

- A. All automatic remote control valves shall be appropriately labeled with weather resistant tags.
 - 1. Christy's Maxi ID Tag
 - 2. Material: Polyurethane

2.14 IRRIGATION HEADS AND NOZZLES

- A. Per Plan

2.15 DRIP EQUIPMENT

- A. Per Plan
- B. All fittings shall be barb spin-lock type

EXECUTION

3.01 SITE CONDITIONS

- A. Observations:
 - 1. Prior to all work of this section, carefully observe/review the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 - 2. Verify that irrigation that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards and manufacturer's recommendations.
 - a. Discrepancies:
 - 3. In the event of discrepancy, immediately notify the Landscape Architect or Owner's authorized representative.
 - 4. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.
- B. Grades:
 - 1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
 - 2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.
- C. Field Measurements:
 - 1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
 - 2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.
 - 3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by his operations or neglect.
- D. Diagrammatic Intent:

1. The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to Owner.
- E. Layout:
 1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventer, and automatic controller.
 2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.
- F. Water Supply:
 1. Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.
- G. Electrical Service:
 1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.
 2. Contractor shall make electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.

3.02 TRENCHING

- A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below sub grade.
- B. Provide minimum cover over top of underground piping according to the following:
 1. Irrigation Mainline Piping: Minimum depth of 24 inches below finish grade.
 2. Later Piping: 18 inches below finish grade.
 3. Sleeves: 24 inches under paving, 36 beneath roadways.
 4. Pipes installed in a common trench shall have a 2 inch minimum space between pipes.

3.03 BACKFILLING

- A. Mainlines:
 1. Pipe and wiring shall sit on 2" of sand.
 2. Pipe and wiring shall then be covered by 8" of sand.
 3. Trench shall then be backfilled with planting soil per Section 32 91 00.
- B. Lateral Lines:
 1. Pipe and wiring shall sit on 2" of sand.
 2. Pipe shall then be covered by 4" of sand.
 3. Trench shall then be backfilled with planting soil per Section 32 91 00.

- C. Soil Backfill:
 - 1. Compact to a density equal to the surrounding undisturbed soil, but not less than 90%.
 - 2. Subsequent depressions filled at the contractors expense.
 - 3. Particular attention is directed to firmly tamp and moisten around sprinkler heads and quick couplers.
- D. Flooding in lieu of tamping is not allowed.
- E. Under no circumstances shall truck wheels be used to compact backfill.

3.04 SLEEVING AND BORING

- A. Install sleeving at a depth that permits the encased pipe or wiring to remain at the specified burial depth.
- B. Extend sleeve ends six inches beyond the edge of the paved surface. Cover pipe ends and mark with stakes.
 - 1. At specialized concrete surfaces the Landscape Architect or Owners Representative will need to approve of any concrete markings.
 - a. Bore for sleeves under obstructions that cannot be removed. Employ equipment and methods designed for horizontal boring.

3.05 PIPING

- A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.
- B. Cutting or breaking of existing pavement is not permitted.
- C. Carefully observe all pipe and fittings before installation, removing dirt, scale, burrs and reaming. Install pipe with all markings up for visual observation and verification.
- D. Remove all dented and damaged pipe sections.
- E. All lines shall have a minimum clearance of 6 inches from each other and 12 inches from lines of other trades.
- F. Parallel lines shall not be installed directly over each other.
- G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.
- H. PVC pipe shall be installed in a manner which will provide for expansion and contraction as recommended by the pipe manufacturer.
- I. Center load all plastic pipe prior to pressure testing.
- J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.

- K. Transition Fittings: Use transition fitting for plastic-to-metal pipe connection according to the following:
1. Couplings:
 - a. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - b. Underground Piping NPS 2 and Larger: AWWA transition coupling.
 2. Fittings:
 - a. Aboveground Piping: Plastic-to-metal transition fittings.
 - b. Underground Piping: Union with plastic end of same material as plastic piping.
 - c. Use dielectric fittings for dissimilar-metal pipe connections according to the following:
 - 1) Underground Piping
 - (a) NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
 - (b) NPS 2-1/2 and Larger: Prohibited except in valve box.
 - 2) Aboveground Piping
 - (a) NPS 2 and Smaller: Dielectric unions.
 - (b) NPS 2-1/2 to NPS 4: Dielectric flanges.
 - 3) Piping In Valve Boxes or Vaults:
 - (a) NPS and Smaller: Dielectric unions.
 - (b) NPS 2-1/2 to NPS 4: Dielectric flanges.
 - 4) Dielectric fittings are specified in Division 2 Section "Piped Utilities - Basic Materials and Methods."

3.06 TRACER WIRE / MARKING TAPE

- A. Set tracing wire over all pressurized mainline pipe. Tape at 10 foot intervals to pipe.
- B. Set tracer tape flat over all irrigation mainlines. Install tracer tape 6" above mainlines and a minimum of 12" below grade. Tracer tape shall be a minimum of 3" wide, except when otherwise noted.

3.07 CONTROLLER

- A. The exact location of the controller shall be approved by the Landscape Architect or Owner's authorized representative before installation. The electrical service shall be coordinated with this location.
- B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.
- C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

3.08 FLOW SENSOR

- A. Install per manufacturers instructions.

3.09 CONTROL WIRING

- A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.

- B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.
- C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18 inch service loop at each connection.
- D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.
- E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.

3.10 VALVES

- A. Automatic control valves, quick coupler, and gate valves are to be installed in the approximate locations indicated on the drawings.
- B. Valves shall be installed in shrub areas whenever possible.
- C. Install all valves as indicated in the detail drawings.
- D. Valves to be installed in valve boxes shall be installed one valve per box.

3.11 VALVE BOXES

- A. Valve boxes shall be installed in shrub areas whenever possible 2 feet back from edge of paving.
- B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, six inch deep extending six inches beyond the perimeter of the box, minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and two inches above finish grade in ground cover areas.

3.12 INSTALLATION OF SPRINKLER IRRIGATION COMPONENTS

- A. Automatic Control Valve (ACV):
 - 1. Flush mainline before installation of ACV assembly.
 - 2. Install where indicated on the drawings. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve wires. Install connectors and sealant per the manufacturer's recommendations.
 - 3. Adjust ACV to regulate the downstream operating pressure
- B. Sprinkler Assembly:
 - 1. Flush lateral pipe before installing sprinkler assembly.
 - 2. Install per the installation details at locations shown on the drawings.
 - 3. Set sprinklers perpendicular to the finish grade.
 - 4. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.
 - 5. Adjust the radius of throw of each sprinkler for best performance.
- C. Drip Irrigation Assembly:
 - 1. Flush lateral pipe before installing drip assembly.

2. Install per the installation details at locations shown on the drawings.

3.13 MISCELLANEOUS EQUIPMENT

- A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.
- B. Quick coupler valves shall be set approximately 12 inches from walks, curbs, header boards, or paved areas where applicable.
- C. Install devices such as rain sensors, freeze sensors, flush valves, air relief valves and master valves as indicated on the drawings and as recommended by the manufacturer.

3.14 FLUSHING THE SYSTEM

- A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.
- B. Irrigation heads shall be installed after flushing the system has been completed.

3.15 ADJUSTING THE SYSTEM

- A. Contractor shall adjust valves, align heads, and check the coverage of each system prior to coverage test.
- B. If it is determined by the Landscape Architect or Owner's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.
- C. The entire system shall be operating properly before any planting operations commence.
- D. Automatic control valves are to be adjusted so that the irrigation heads and drip tubing operate at the pressure recommended by the manufacturer.

3.16 TESTING AND OBSERVATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.
- B. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, Owner, and governing agencies.
- C. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 72 hours in advance, where and when the work is ready for testing.
 1. Leak Test: After installation, charge system and test for leaks. Exercise care in filling the system to prevent excessive surge pressure and water hammer.
 - a. Piping subject to continuous domestic water pressure to be tested at 150 psi for eight continuous hours with no drop in pressure.

- b. Pipe not subject to continuous domestic water pressure to be tested with water at full main pressure with sprinklers risers capped for two continuous hours with out pressure drop.
 - c. Repair leaks and retest until no leaks exist.
 2. Operational Test: After electrical circuitry has been energized, operate controller and automatic control valves to confirm proper system operation.
 - a. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Coverage Test: Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect. Coverage test must be made prior to the installation of plant material.
 - a. If it is determined that adjustments in the irrigation equipment and spacing will provide more proper coverage, make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as necessary for obtaining complete and adequate coverage in irrigated areas.
 - b. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.

3.17 CLOSING IN UN-INSPECTED WORK

- A. The Contractor will pay costs necessitated by required opening, restoration and correction of work closed in or concealed before inspection, testing as required and approved by authorized inspections.

3.18 START UP SERVICE

- A. Verify that controllers are installed and connected according to the contract documents.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.
- C. Complete startup checks according to manufacturer's written instructions.

3.19 ADJUSTING

- A. Adjust setting of controllers as needed for optimal efficiency.
- B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- C. Adjust sprinklers so they will be flush with, or not more than ½ inch above, finish grade.

3.20 MAINTENANCE

- A. During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

3.21 COMPLETION CLEANING

- A. Clean-up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION

SECTION 32 91 00
SOIL PREPARATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. The work includes furnishing, soil testing and installation of soil and/or amendments for landscape planting areas.
- B. Related Sections
 - 1. 01 56 39: Tree Protection
 - 2. 31 10 00: Site Clearing
 - 3. 31 11 00: Site Preparation
 - 4. 31 20 00: Earth Moving
 - 5. 01 57 13: Temporary Erosion and Sediment Control
 - 6. 32 84 00: Irrigation
 - 7. 32 92 00: Turf and Grasses
 - 8. 32 93 00: Plants

1.03 DEFINITIONS

- A. Acceptable drainage: Drainage rate is sufficient for the plants to be grown. Typical rates for installing Planting Soil are between 1-5 inches per hour. In natural undisturbed soil a much lower drainage rate, as low as 1/8th inch per hour.
- B. Amendment: material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, biological, and pH amendments.
- C. Biological Amendment: Amendments such as Mycorrhizal additives, compost tea, organic matter or other products intended to change the soil biology.
- D. Compacted soil: soil where the density of the soil is greater than the threshold for root limiting, and further defined in this specification.
- E. Compost: well-decomposed stable organic material as defined by the US Composting Council and further defined in this specification.
- F. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units are inches per hour).
- G. End of Warranty Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation (if applicable) work run concurrent with each other, and further defined in this specification.

- H. Existing Soil: Mineral soil existing and stockpiled after the majority of the construction within and around the planting site is completed and just prior to the start of work to prepare the planting area for soil modification and/or planting, and further defined in this specification.
- I. Fertilizer: amendment used for the purpose of adjusting soil nutrient composition and balance.
- J. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification, and further defined in this specification.
- K. Finished grade: surface or elevation of Planting Soil after final grading and 12 months of settlement of the soil, and further defined in this specification.
- L. Graded soil: Soil where the A horizon has been stripped and relocated or re-spread; cuts and fills deeper than 12 inches, and further defined in this specification.
- M. Installed soil: Planting soil and existing site soil that is spread and or graded to form a planting soil, and further defined in this specification.
- N. Minor disturbance: Minor grading as part of agricultural work that only adjusts the A horizon soil, minor surface compaction in the top 6 inches of the soil, applications of fertilizers, installation of utility pipes smaller than 18 inches in diameter thru the soil zone.
- O. Owner's Representative: The person or entity, appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.
- P. Ped: a clump or clod of soil held together by a combination of clay, organic matter, and fungal hyphae, retaining the original structure of the harvested soil.
- Q. Planting Soil: Topsoil, or Planting Soil Mixes which are imported or existing at the site, or made from components that exist at the site or are imported to the site; and further defined in this specification.
- R. Poor drainage: Soil drainage that is slower than that to which the plants can adapt.
- S. Scarify: Loosening and roughening the surface of soil and subsoil prior to adding additional soil on top, and further defined in this specification.
- T. Soil Fracturing: Deep loosening the soil to the depths specified by using a backhoe, and further defined in this specification.
- U. Soil Horizon: A layer parallel to the soil surface, whose physical characteristics differ from the layers above and beneath
- V. Soil Ripping: Loosening the soil by dragging a ripping shank or chisel thru the soil to the depths and spacing specified, and further defined in this specification.
- W. Soil Tilling: Loosening the surface of the soil to the depths specified with a rotary tine tilling machine, rototiller, (or spade tiller), and further defined in this specification.

- X. Soil trenching: Cutting narrow trenches through the soil at the depths and spacing specified to loosen the soil profile, and further defined in this specification.
- Y. Subgrade: surface or elevation of subsoil remaining after completing excavation or grading, or top surface
- Z. Subsoil: surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.
- AA. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation (if applicable) where the Owner's Representative accepts that all work in these sections is complete, and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project and further defined in this specification.
- BB. Topsoil: naturally produced and harvested soil from a horizon or upper layers or the soil as further defined in this specification.
- CC. Undisturbed soil: soils with the original a horizon intact that have not been graded or compacted. soils that have been farmed, subjected to fire or logged but not graded, and natural forested land will be considered as undisturbed.
- DD. Usc: U.S. composting council.

1.04 SUBMITTALS

- A. Product data: One for each type of Product indicated in Part 2.
- B. Samples for Verification: One sample labeled for each product and each source and location, site or supplier in which is to be furnished.
 - 1. Sample Soil mixes - 0.5 cubic foot
 - 2. Compost - 0.5 cubic foot.
 - 3. Coarse Sand - 0.5 cubic foot.
- C. Product Certificates: One for each type of manufactured product, from the manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.
 - 2. Analysis of other materials by a recognized laboratory-made according to methods established by the Association of Official Analytical Chemists, where applicable.
- D. Qualification Data: One for each testing agency.
- E. Material Test Reports: Provided a minimum of 30 days prior to beginning soil preparation work or delivery of material to the site. Reports to clearly identify each product, source, and location, site or supplier in which is to be furnished.
 - 1. Soil Fertility and Agricultural Suitability Analyses and Recommendations for the following:
 - a. Existing soil
 - b. Imported topsoil
 - c. Amended Planting Soil
 - 2. Compost Analysis: Provide analysis for one representative sample.

3. Soil Compaction Test: Provide results of soil compaction tests a minimum of 7 days prior to planting and seeding.
4. Coarse Sand particle size distribution.
- F. Noxious Weed Germination Test:
 1. Minimum of one 36-inch square by 3-inch-deep soil sample for each topsoil source considered for use on the project. Place soil in tray with adequate drainage layer beneath, keep soil moist (not saturated) for 7 days in a temperature-controlled greenhouse environment, provide photos and written reports summarizing germination results.
- G. Delivery Slips: Provide delivery slips as proof of shipment of specified materials.
- H. Rough Grading: Contractor to notify Inspecting Agency a minimum of 72 hours prior to inspection for rough grading soils. All rough grading operations shall be completed per specification and civil plans and prepared for inspections. Topsoil placement or backfilling in areas to be landscaped shall not occur until the Inspecting Agency has issued written approval.
- I. Topsoil Inspection: No transportation or placement of imported or stockpiled topsoil shall occur until the Inspecting Agency has issued written approval.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in the successful establishment of plants.
 1. Experience: Submit statement and outline of qualifications showing five years' experience in landscape installation and a minimum of five projects that are similar in scale and complexity in addition to requirements in Division 01 Section "Quality Requirements."
 2. Installer's Field Supervision: Require Installer to maintain an experienced fulltime supervisor on Project site when work is in progress.
- B. Soil Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
 1. Acceptable Soil Testing Laboratories are:
 - a. Soil and Plant Laboratory, Inc, (503) 557-4959.
 - b. A & L Western Agricultural Laboratories, (503) 968-9225.
 - c. Western Laboratories, Inc., (800) 658 3858
 - d. Or equal
 2. Soils Samples
 - a. Initial Collection: Volume, quantity, sources and locations individually labeled in separate clear plastic sealed bags for identification. Samples shall be typical of the lot of material to be furnished; provide an accurate

- representation of color, texture, and organic makeup. Provide in accordance with the Testing Agencies recommendations.
- b. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.
 - c. Existing Soil: Take multiple representative samples from the center of the area of no less than five equally divided sections at each location and source. Provide the testing agency one thoroughly mixed sample from each location, clearly labeled as described herein.
 - d. Imported Topsoil: Take one representative collection from each offsite source. Provide the testing agency one sample from each location, clearly labeled as described herein.
 - e. Final Collection: After amended planting soil has been placed and prepared for planting. Take a minimum of five representative samples of amended planting soil that has been placed and prepared for planting. Provide the testing agency one sample from each location, clearly labeled as described herein.
3. Soils Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating:
- a. Soil Composition: USDA particle size analysis indicating percentages of sand, silt and clay, and percent organic matter.
 - b. Macro and micronutrient fertility tests as determined by pH, salinity, nitrate nitrogen, ammonium nitrogen, phosphate phosphorus potassium, calcium, magnesium, soluble copper, zinc, manganese, iron, saturation extract boron and sodium analyses.
 - c. Recommendations by the soil testing lab for fertilizer and soil amendments in pounds per 1,000 square foot or tons per acre, as necessary to correct soil deficiencies.
 - d. Report suitability of tested soil for plant growth.
 - 1) Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1,000 square feet or volume per cubic yard for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - 2) Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

- e. Include the implementation and preparation of the planting topsoil with the recommended fertilizers and soil amendments in the weights and percentages identified in the soil analysis.
- C. Compost Testing Laboratory Qualifications: An independent laboratory, with the experience and capability to conduct the testing indicated following the US. Composting Council Seal of Testing Assurance (STA) procedures, or equivalent.
 1. Acceptable STA Compost Testing Laboratories are:
 - a. A & L Western Agricultural Laboratories, (503) 968-9225
 - b. Control Laboratories, (831) 724-5422.
 - c. Or equal.
 2. Compost Samples:
 - a. Provide documentation from the supplier that compost has reached a monitored temperature of 140 degrees Fahrenheit for at least one week. Engage an independent soil testing laboratory to test representative sample(s) of compost and furnish compost analysis report for the following parameters:
 - 1) Percent organic matter, percent moisture, percent inerts (foreign matter), pH, soluble salts, and particle size.
 - 2) Nutrient content, including Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), and Magnesium (Mg) and Sulfur (S).
 - 3) Trace Metals, including Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), and Zinc (Zn).
 - 4) Maturity Indicator. Provide bio-assay results. Provide Carbon-Nitrogen ratio.
 - 5) Stability Indicator: Provide respiration test results.
- D. Noxious Weed Germination Test:
 1. If regenerative noxious weeds (including, but not limited to, dandelion, jimsonweed, morning glory, rush grass, mustard, lambsquarter, chickweed, cress, crabgrass, Canadian thistle, nutgrass, poison oak, blackberry, tansy ragwort, Bermuda grass, johnson grass, poison ivy, nimble will, bindweed, bent grass, wild garlic, perennial sorrel, brome grass, quack grass, nutsedge grass, and horsetail) are present in the soil, all resultant growth including roots shall be removed throughout the one-year period after acceptance of work at no additional cost to Owner.
- E. Provide the Owner the Soil Testing Agencies results of the in-place prepared soils before planting for compliance with specifications.
- F. Request inspection and allow observation by the Owner 's authorized representative of prepared soils before planting.
- G. All delivered and installed Planting Soil shall conform to the approved submittals sample color, texture and approved test analysis.

- H. Owner may run independent tests from soil samples delivered to the site before or after installation to verify compliance with specifications and soil analysis to confirm the planting soil conforms to the approved material.
 - 1. All testing shall be performed by the same soil lab that performed the original Planting Soil testing.
 - 2. Testing results shall be within 1 plus or minus of the values measured in the approved Planting Soil Mixes.
 - 3. Soils found to not meet specifications will be rejected and shall either be removed from the site and replaced and/or modified to meet specifications requirements at no cost to the Owner.

1.06 SITE CONDITIONS

- A. Be aware of all surface and subsurface conditions, and to notify the Owner's authorized representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
 - 1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner's authorized representative in writing, stating the conditions and submit a proposal covering the cost of corrections. If the Contractor fails to notify the Owner's Representative of such conditions, they shall remain responsible for plant material under the warranty clause of the specifications.
 - 2. This specification requires that all Planting Soil and Irrigation work be completed and accepted prior to the installation of any plants.
- B. Environmental Requirements:
 - 1. Plant or install materials during normal planting seasons for each type of planting required.
 - 2. Planting shall not be permitted during the following conditions:
 - a. Cold weather: less than 32 0 F.
 - b. Hot weather: greater than 90 0 F.
 - c. Wet weather: surface water/saturated soil.
 - d. Windy weather: wind velocity greater than 30 m.p.h.
 - 3. Prepare soil only when topsoil is not saturated, muddy or frozen.
- C. Regulatory Requirements:
 - 1. Comply with all regulatory agencies for fertilizer and herbicide composition.

1.07 SOIL COMPACTION - GENERAL REQUIREMENTS

- A. Except where more stringent requirements are defined in this specification, the following parameters shall define the general description of the threshold points of soil compaction in existing, modified or installed soil and subsoil.
 - 1. Standard Proctor Method ASTM D 698

- B. The following are threshold levels of compaction as determined by each method.
 - 1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.
 - a. Standard Proctor Method 75 - 85%. Soil below 75% is unstable and will settle excessively.
 - 2. Root limiting Compaction: Root growth is limited with fewer, shorter and slower growing roots.
 - a. Standard Proctor Method - above 85%.
 - 3. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.
 - a. Standard Proctor Method - Above 90%.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity.
 - 1. Handling saturated soil can create long-term drainage problems. After installation and planting, all planting areas shall have a minimum drainage rate of 3/4" per hour.
- B. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.
- C. Deliver all chemical amendments in original, unopened containers with original labels intact and legible, which state the guaranteed chemical analysis. Store all chemicals in a weather-protected enclosure.
- D. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard and installed soils, from windy rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust, and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.
- E. Bulk material: Coordinate delivery and storage with the Owner's Representative and confine materials to neat piles in areas acceptable to Owner's Representative.

1.09 OBSERVATION OF WORK

- A. The Owner's Representative shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Owner's Representative shall be afforded sufficient time to schedule a visit to the site.
 - 1. Excavation review: Observe each area of excavation prior to the installation of any Planting Soil.

2. Completion of soil modifications review: Upon completion of all soil modification and installation of planting soil.
3. Completion of fine grading and surface soil modifications. Upon completion of all surface soil modifications and fine grading but prior to the installation of shrubs, ground covers, or lawns.

1.10 EXCAVATING AND GRADING AROUND UTILITIES

- A. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Determine the location of underground utilities and perform work in a manner that will avoid damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Notification of the local utility locator service is required for all planting areas.

1.11 SEQUENCING AND SCHEDULING

- A. Provide the following notices to the Architect:
 1. In advance of planting soil delivery so that the Owner may schedule independent laboratory testing on imported soil: 7 days.
 2. In advance of plant material delivery so that plants may be inspected upon site delivery: 7 days.
 3. Before the Owner is to assume maintenance responsibility: 7 days.
 4. Before time requested for inspection for Substantial Completion: 7 days, in writing.

1.12 WARRANTY

- A. Installer agrees to warrant all work for one year from the date of Final Completion.

2PART 2 PRODUCTS

2.01 SOIL SOURCES ON GRADE

- A. Existing Soils: Verify existing stockpiled surface soil meets the requirements of planting soil from the analysis of Soil Testing.
 1. Supplement with imported or manufactured planting soil from off-site sources when quantities are insufficient.
 2. Native stockpiled planting soil shall be:
 - a. Covered to prevent contamination, erosion and to reduce weed development.
 - b. Screened of all deleterious material greater than 1/2" diameter including but not limited to clay lumps, glass, concrete, asphalt, rubble, rock, stone, debris, litter and toxic matter harmful to plant growth.
 3. A soil texture analysis shall be performed to ensure native stockpiled soil meets acceptable mixture of sand, clay, and silt. Loam type soil is desired. Soil to not exceed 40% clay.

4. Add amendment materials per soil test recommendations. All soil amendments required shall be thoroughly mixed into the stockpiled topsoil immediately prior to placement (within 2 days) so as to avoid breakdown of organics in the stockpile. Provide documentation that:
 - a. N-P-K levels are sufficient
 - b. Organic Matter is 5% minimum
 - c. pH levels are within 6.0 and 8.0
 5. If unit cost to amend native stockpiled soil exceeds unit cost for imported amended topsoil, imported amended topsoil to be used.
- B. Imported Soil: Approved soil from off-site sources for planting beds and hydro-seeded meadow areas. Planting soil components shall consist of the following:
1. 30 – 40% by volume Sandy Loam per USDA textural classification of soil:
 2. 30 – 40% by volume Sand (see above section)
 3. 30 – 40% by volume Compost (see above section)
 4. Adjust the above amounts to achieve the following in addition to the general requirements listed in paragraph 2.7B above:
 - a. Organic content for planting: Minimum of 10% organic content by dry weight per LOI
 - b. Organic content for turf areas: Minimum of 5% organic content by dry weight per LOI
 - c. Fines as defined by #200 sieve: not more than 15%. Provide laboratory testing per this section. (AASHTO T88)
 - d. Soil amendments and fertilizers per soil test.
 - e. Add or deduct types and amounts per soil test results for plant growth requirements. Provide final amounts and types as part of submittals for approval.

2.02 ORGANIC SOIL AMENDMENTS

- A. Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
1. The carbon to nitrogen ratio of the compost shall be below 25:1.
 2. The compost shall have an organic matter content of 40% to 65% as determined by the "loss on ignition" test method.
 3. Compost feedstocks shall be:
 - a. 98% landscape waste (Type I)
 - b. 2% of food waste (Type III)
 4. Compost shall meet the following particle size distribution:
 - a. Percent passing
 - b. 1 inch (9.5 mm) 99-100
 - c. 5/8 inch (9.5 mm) 90-100

- d. 1/4 inch (9.5 mm) 40-90
- 5. pH shall be between 6.0 and 8.0.
- 6. Manufactured inert material shall be less than 1% percent by dry weight.
- 7. Organic matter content shall be between 40% and 65% percent by dry weight.
- 8. Soluble salt content less than 4 mmho/cm.
- 9. Maturity shall be over 80% per T MECC 05.05-A, "Germination and Vigor. Stability shall be 7 or below per T MECC method 05.08-B. 1 0. Yard waste shall be from a permitted composting facility
- 10. The compost shall be free of objectionable odors.
- 11. Sizes
 - a. Medium Compost – Subgrade preparation
 - b. Fine Compost – Planting soil mix

2.03 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent applied at a rate recommended by soil testing and as follows:
 - 1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
 - 2. Provide lime in the form of dolomitic limestone.

2.04 LAWN/TURF AREAS – IMPROVED ROOT ZONE MIX

- A. The root zone shall be sand and topsoil. The Root zone mix shall be a mixture of 50% coarse sand and 50% topsoil by volume. Root zone mix shall conform to the following analysis:
 - 1. Coarse Sand: Clean, washed, sand, free of toxic materials shall be sharp, free of limestone, shale and slate particles.
 - a. Manufactured Coarse Sand shall not be permitted.
 - b. Free of salts and any other materials that would be detrimental to turf growth
 - c. Particle size distribution:

1)	Percent of Particles PassinG	
2)	No. 4 (4.5 mm)	100
3)	No. 10 (2.0 mm)	95-100
4)	No. 16 (1.0 mm)	85-100
5)	No. 30 (0.5 mm)	50-70
6)	No. 60 (0.25 mm)	0-30
7)	No. 140 (0.10mm)	0-10
8)	No. 200 (0.07mm)	0.5
9)	No. 270 (0.01mm)	0
 - 2. Topsoil:

- a. Existing or Imported soil source as noted herein. Soil source shall be screened of all deleterious material greater than 1/2" diameter and amended meeting the requirements as noted herein.
3. Physical and chemical properties of Root Zone Mix (mix of sand and topsoil)
 - a. Sand and topsoil shall be mixed prior to placement.
 - b. pH: 6.0 to 8.0
 - c. C:N Ratio: 12:1 to 25:1
 - d. Organic Matter by LOI: 5%
 - e. Infiltration rate of at least 8-in./hour per ASTM D2434 at 90% compaction per ASTM D1557
 - f. Cation exchange capacity: >5 meq/ 100g soil
 - g. Maximum exchangeable sodium: 10 percent
 - h. Sodium Absorption Ratio:
 - 1) Total porosity: 35-55%
 - 2) Aeration porosity: 15-25%
 - 3) Capillary porosity: 15-25%
 - 4) Uniformity coefficient; 2.5-3.5

2.05 HERBICIDES

- A. General: pesticides/herbicides registered and approved by EPA, acceptable to authorities having jurisdiction, and of the type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Herbicide Types:
 1. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
 2. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.
- C. All applications of herbicides or pesticides require notification procedures as outlined in Section 32 93 00 Plants.
- D. Use of herbicides not allowed in stormwater facilities, by bodies of water, during a rain event, or in winds exceeding 5 mph.

2.06 STORMWATER FACILITIES

- A. Refer to Civil Engineers Plans for required soil media specifications.

2.07 BIOTIC SOIL AMENDMENT

- A. Soil Builder Blend (Alternative to Permamatrix)
 1. Hydraulically applied biotic soil amendment as manufactured by Sunmark Seeds International, Inc.
 - a. www.sunmarkseeds.com

b. Phone: 503.241.7333

3PART 3 EXECUTION

3.01 SITE EXAMINATION

- A. Prior to the installation of Planting Soil, examine the site to confirm that existing conditions are satisfactory for the work of this section to proceed. Confirm the following.
1. Subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope as shown in the drawings
 2. Surface and subgrades of all areas to be filled with Planting Soil are free of trash, construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.
 3. Subgrade has been prepared.
 4. No adverse drainage conditions are present
 5. No conditions are present which are detrimental to plant growth.
 6. Utility work has been completed per the drawings.
 7. Irrigation work, which is shown to be installed below prepared soil levels, has been completed.
 8. Weather conditions are appropriate for installation activities.
- B. If unsatisfactory conditions are encountered, notify the Owner's Representative immediately to determine corrective action before proceeding.

3.02 COORDINATION WITH PROJECT WORK:

- A. The Contractor shall coordinate with all other work that may impact the completion of the work.
- B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.
- C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.03 GRADE AND ELEVATION CONTROL

- A. Provide grade and elevation control during the installation of Planting Soil. Utilize grade stakes, surveying equipment, and other means and methods to assure that grades and contours conform to the grades indicated on the plans.

3.04 WEED CONTROL

- A. after finish grades have been approved. cycle irrigation of all planting and seeded areas. wait ten days minimum and inspect all planting areas for the presence of any additional weeds. if weeds are present, apply an application of approved herbicide to affected

areas and delay planting until all weeds are dead and removed. follow the manufacturer's recommendations for herbicide application.

3.05 SITE PREPARATION

- A. Excavate to the proposed subgrade. Maintain all required angles of repose of the adjacent materials as shown in the drawings or as required by this specification. Do not over excavate compacted subgrades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving and structures where the bottom of the paving or structure is above the bottom elevation of the excavated planting area.
- B. Remove surplus soil and waste material including weeds, excess subsoil, unsuitable soil, trash, debris, construction debris and construction material on the surface and subgrade. Legally dispose of the waste off of the Owner's property.
- C. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope approximately parallel to the finished grade as shown on the drawings.
- D. In areas where Planting Soil is to be spread, confirm subgrade has been scarified and left lumpy and uncompacted.
- E. Protect adjacent walls, walks, and utilities from damage or staining by the soil. Use 1/2 inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work, and other items as directed during the progress of the work.
 - 1. At the end of each working day, clean up any soil or dirt spilled on any paved surface.
 - 2. Any damage to the paving or site features or work shall be repaired at the Contractor's expense.

3.06 PLACEMENT OF IMPROVED ROOT ZONE MIX IN LAWN/TURF AREAS

- A. Prior to placement of the Improved Root Zone Mix, the Owner's Representative shall approve the condition of the subgrade and the previously installed subgrade preparation and drainage.
- B. Root Zone Mix
 - 1. Depth per soils plan.
 - 2. Place root zone mix over ripped and prepared subgrade.
 - 3. Use only equipment with less than 15 psi and turf type tires on the field at any time for the construction of any part of the field area.
 - 4. Compact to 90% dry density. Root zone mix to be moist when placed to discourage migration into gravel and to assist firming.
 - 5. The root zone mix shall be kept watered to ensure stability and achieve a compaction rate of 90%.
 - 6. Drag field to achieve a smooth, uniform, compacted seedbed. Level by dragging and/or raking to remove high spots and to fill depressions.

7. Prior to hydro-seeding, saturate the fields to identify any settlement.

3.07 PLACING PLANTING SOILS:

- A. Prior to placement of Planting Soils, the Owner's Representative shall approve the condition of the subgrade and the previously installed subgrade preparation and drainage.
- B. All equipment utilized to install or grade Planting Soils shall be a wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6-inch long teeth to scarify any soil that becomes compacted.
- C. Prepare subsoil as follows, based on soil depth:
 - 1. For areas with imported planting soil:
 - a. Cross Scarify/Rip 6-inches depth where not in conflict with the critical root zone of trees to remain or structural compaction.
 - b. Leave ripped sub-grade loose and lumpy. Do no additional grading to sub-grade prior to installing planting soil. Protect subsoil from compaction.
 - c. Install Planting Topsoil per Soils Plan.
 - d. Rake smooth as required to remove clumps or mounds.
- D. Install the Planting Soil in 6-inches or less lifts. Apply compacting forces to each lift as required to attain the required compaction. Scarify the top of each lift prior to adding more Planting Soil by dragging the teeth of a loader bucket or backhoe across the soil surface to roughen the surface.
- E. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of each bed area.
- F. Where possible place large trees first and fill Planting Soil around the root ball.
- G. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in Planting Soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Avoid all travel, including foot traffic, over wet soil.
- H. The depths and grades shown on the drawings are the final grades after settlement and shrinkage of the compost material. The Contractor shall install the Planting Soil at a higher level to anticipate this reduction of Planting Soil volume, taking into account the displacement of root balls and container stock. A minimum settlement of approximately 10 - 15% of the soil depth is expected. All grade increases are assumed to be as measured prior to the addition of surface Compost till layer, mulch, or sod.

- I. Within the critical root zone of trees to remain, carefully loosen with hand tools the existing soil to an site arborist approved depth". Add a site arborist approved depth of amended planting soil to roughened grade and hand rake in to incorporate.

3.08 COMPACTION REQUIREMENTS FOR INSTALLED PLANTING SOIL

- A. Compact installed Planting Soil to the compaction rates indicated and using the methods approved for the soil mockup. Compact each soil lift as the soil is installed.
- B. Maintain moisture conditions within the Planting Soil during installation or modification to allow for satisfactory compaction. Suspend operations if the Planting Soil becomes wet. Apply water if the soil is overly dry.
- C. Provide adequate equipment to achieve consistent and uniform compaction of the Planting Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction. Use the same equipment and methods of compaction used to construct the Planting Soil mockup.
- D. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.
 1. Lightweight equipment such as trenching machines or motorized wheelbarrows is permitted to pass over finished soil work.
 2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of the paragraph "Over Compaction Reduction" below.

3.09 OVER COMPACTION REDUCTION

- A. Any soil that becomes compacted to a density greater than the specified density and/or the density in the approved mockup shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Planting Soil is installed and approved.
- B. Compaction of wet soils may require additional remediation, including removal and replacement, as determined by the Owner's Representative. Any removal and replacement of soil will be at no cost to the Owner.
- C. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater below finished grade.

3.10 INSTALLATION OF CHEMICAL ADDITIVES

- A. Following the installation of each soil and prior to fine grading and installation of mulch layer, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.
- B. Types, application rates and methods of application shall be approved by the Owner's Inspecting Agency prior to any applications.

3.11 FINE GRADING

- A. The Owner's Inspecting Agency shall approve all rough grading prior to fine grading, planting, and mulching.

- B. Grade the finished surface of all planted areas to meet the grades shown on the drawings, allowing the finished grades to remain higher (10 - 15% of depth of soil modification) than the grades on the grading plan, as defined in paragraph Planting Soil Installation, to anticipate settlement over the first year,
- C. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.
- D. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Owner's Representative in the event that conditions make it impossible to achieve positive drainage.
- E. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after the settlement is one or two inches below all paving surfaces or as directed by the drawings.
- F. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a 2-inch deviation from the plane in 10 feet. The tolerance for dips and bumps in lawn areas shall be a 1-inch deviation from the plane in 10 feet.

3.12 CLEAN-UP

- A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
 - 1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris from all surfaces within the project or on public right of ways and neighboring property.
- B. Once the installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site.
 - 1. Make all repairs to grades, ruts, and damage to the work or other work at the site.
 - 2. Remove and dispose of all excess planting soil, subsoil, mulch, plants, packaging, trash, and other material.

3.13 PLANTING SOIL PROTECTION

- A. The Contractor shall protect installed Planting Soil from damage including contamination and over compaction due to other soil installation, planting operations, operations by other Contractors or trespassers, and adverse weather including rainfall. Maintain protection during installation until acceptance. Utilize fencing, plastic sheeting, and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged Planting Soil immediately.

- B. Loosen compacted Planting Soil and replace Planting Soil that has become contaminated or over-compacted when wet, as determined by the Owner's Representative. Planting Soil shall be loosened or replaced at no expense to the Owner.
 - 1. Till and restore grades to all soil that has been driven over or compacted during the installation of plants.

3.14 PROTECTION DURING CONSTRUCTION

- A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers.
 - 1. Maintain protection during installation until the date of plant acceptance (see specifications section - Planting). Treat, repair or replace damaged work immediately.
 - 2. Provide temporary erosion control as needed to stop soil erosion until the site is stabilized with mulch, plantings or turf.
- B. Damage to existing or installed plants, or any other parts of the work or existing features to remain, including large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced at no expense to the Owner.
- C. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory. Damage to existing trees shall be assessed by a certified arborist.

3.15 SUBSTANTIAL COMPLETION ACCEPTANCE

- A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.
- B. The date of substantial completion of the planting soil shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections are complete.

3.16 FINAL ACCEPTANCE / SOIL SETTLEMENT

- A. At the end of the plant warranty and maintenance period, (see Specification section 32 93 00 Plants) the Owner's Representative shall observe the soil installation work and establish that all provisions of the contract are complete, and the work is satisfactory,
 - 1. Restore any soil settlement and or erosion areas to the grades shown on the drawings. When restoring soil grades remove plants and mulch and add soil before restoring the planting. Do not add soil over the root balls of plants or on top of the mulch.
- B. Failure to pass acceptance: If the work fails to pass final acceptance, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owner's Representative.

END OF SECTION

**SECTION 32 92 00
TURF AND GRASSES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes
 - 1. Seeding.
 - 2. Hydroseeding.
 - 3. Turf renovation.
- B. Related Sections
 - 1. 31 25 00 – Erosion and Sedimentation Control
 - 2. 32 91 00 – Soil Preparation
 - 3. 32 93 00 – Plants

1.03 DEFINITIONS

- A. Retain terms that remain after this Section has been edited for a project.
 - 1. Finish Grade: Elevation of finished surface of planting soil.
 - 2. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
 - 3. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
 - 4. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 00 "Soil Preparation" and drawing designations for planting soils.
 - 5. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

- 6. Weeds: Including Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at location specified by Architect.
 - 1. INFORMATIONAL SUBMITTALS
 - 2. Qualification Data: For landscape Installer.
 - 3. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 4. Product Certificates: For fertilizers, from manufacturer.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
 - 1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
 - 2. Experience: Five years' experience in turf installation in addition to requirements in Section 01 40 00 "Quality Requirements."
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Pesticide Applicator: State licensed, commercial.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

- B. Seed in damaged packaging is not acceptable.
 - 1. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
 - 1. Time limit in "Sod" Paragraph below is requirement of TPI's "Guideline Specifications to Turfgrass Sodding." Coordinate time limit in "Sodding" Article for laying sod. Insert sod-reinforcing requirements if required for uses such as swales and intermittent waterways.
- D. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.

1.08 FIELD CONDITIONS

- A. Planting Restrictions: See Section 32 93 00 "Plants" for planting restrictions.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 PRODUCTS

2.01 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
- B. Retain "Seed Species" Paragraph below if specifying grass seed and mixes by species. Delete if specifying proprietary grass-seed mixes.
- C. Seed Species:

1. Quality: Seed of grass species as listed below, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
- D. Grass-Seed Mix: Proprietary seed mix as specified in drawings.

2.02 FERTILIZERS

- A. Commercial "Starter" Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
- B. Composition: 25 percent nitrogen, 5 percent phosphorous, and 10 percent potassium, by weight.
- C. Fertilizer should include Iron as amendment.
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended by local grass supplier.

2.03 BIOTIC AMENDMENT

- A. Section 32 91 00 – Soil Preparation

2.04 SOIL AMENDMENTS

- A. Section 32 91 00 – Soil Preparation

2.05 MULCHES

- A. Lawn Repair:
1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
 2. Free from weeds, foreign matter detrimental to plant life, and dry hay or cornstalks are not acceptable.
- B. Hydroseeding
1. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
 2. Non-asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.06 PESTICIDES AND HERBICIDES

- A. Section 32 93 00 – Plants

2.07 ACCESSORIES

- A. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

2.08 TESTS

- A. Provide analysis of topsoil fill under provisions of Section 32 93 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this Section.
- B. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
- C. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
- D. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
- E. Uniformly moisten excessively dry soil that is not workable, or which is dusty.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.02 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- B. Protect adjacent and adjoining areas from hydroseeding and hydro mulching overspray.
- C. Protect grade stakes set by others until directed to remove them.
- D. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 SUB-GRADE PREPARATION

- A. See Section 32 91 00 "Soil Preparation" for specifications on sub-grade preparation.

3.04 PLANTING SOIL PREPARATION FOR SEEDED AREAS

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 00 "Soil Preparation."
- B. Apply depth of planting soil as indicated on drawings over prepared sub-grade for lawn and seeded areas.
- C. Mix soil amendments and fertilizers with planting soil at rates recommended by the Soil Testing Laboratory. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days. Either mix soil before spreading or apply soil amendments on the surface of spread planting soil and mix thoroughly into top 3 inches before planting.
- D. Mix lime as needed with dry soil prior to mixing fertilizer.
- E. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or sub-grade is frozen.
- F. Grade areas to be seeded to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1 inch in any dimension, and other objects that may interfere with planting or establishment operations.
- G. Roll with a heavy roller, 200-300 lbs. to remove humps and hollows.

- H. Do not drive equipment with total PSI greater than 15 psi at any time over the subgrade, prepared seed bed or final seeded areas. Any area impacted by such equipment resulting in soil compaction greater than acceptable standards listed in 32 91 00 "Soil Preparation" will require remediation to de-compact and re-compact per 32 91 00 "Soil Preparation" at contractor's expense and reseeded of same area.
- I. Moisten prepared areas to be seeded before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- J. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.
- K. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.05 WEED CONTROL

- A. Section 32 91 00 – Soil Preparation

3.06 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, manufacturer recommended fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
- B. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
- C. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
- D. Do not hydroseed area in excess of that which can be mulched on the same day.
- E. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- G. Following germination, immediately re-seed areas without germination seeds that are larger than 4 by 4 inches.

3.07 TURF RENOVATION

- A. Renovate existing turf where indicated.
- B. Renovate turf damaged by Contractor's operations including but not limited to storage of materials or equipment, construction activity, and movement of vehicles.
- C. Reestablish turf where settlement or washouts occur or where minor regrading is required.
- D. Install new planting soil as required.
- E. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- F. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- G. Mow, dethatch, core aerate, remove cores, top dress 1/2" depth coarse sand and rake existing turf.
- H. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- I. In areas where moss in the lawn is predominant, control the moss first with a product that contains ferrous ammonium sulfate (iron). Then, remove the dead moss by raking or dethatching.
- J. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- K. Till stripped, bare, and compacted areas thoroughly to a soil depth of 8 inches. Top dress/spread 1" minimum depth coarse sand over soil.
- L. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
- M. Soil Amendment(s): according to requirements of Section 32 91 00 "Soil Preparation."

- N. Initial Fertilizer: commercial starter fertilizer applied according to manufacturer's recommendations.
- O. Apply seed and protect with straw mulch as required for new turf.
- P. Water newly planted areas and keep moist until new turf is established.
- Q. Turf seed planting occurring during the months of Jun-September require higher watering needs at a watering application rate of eight-minute cycles, four times daily. Once established (reaching 3 inches in height), watering application rate to be ten-minute cycles, three times daily.

3.08 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
- C. Retain first subparagraph below if mulching is required.
- D. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
- E. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- F. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
- G. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
- H. Revise rate of watering in subparagraph below to suit Project.

- I. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- J. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
- K. Lawn Areas: Mow to a height of 2 to 3 inches.
- L. Turf Postfertilization: Apply slow-release fertilizer after initial mowing and when grass is dry.
- M. Revise option in subparagraph below to suit Project. Halve the amount of nitrogen and apply twice during initial maintenance period if preferred.
- N. Use fertilizer that provides actual nitrogen of at least 2.5 lb/1000 sq. ft. to turf area annually.
- O. Apply two applications of 1.25 lb Nitrogen/100sq. ft. One application in April, and one application in September.

3.09 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
- B. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- C. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.10 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass establishment period.

3.11 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
- B. Seeded Turf Areas: 12 months from date of Substantial Completion.

END OF SECTION

C.

SECTION 32 9300
PLANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Plants.
 - 2. Tree stabilization.
- B. Related Sections:
 - 1. 01 56 39 - Tree Protection
 - 2. 32 84 00 – Irrigation
 - 3. 32 91 00 – Soil Preparation
 - 4. 32 94 13 – Root Barrier
 - 5. 32 92 00 – Turf and Grasses

1.03 UNIT PRICES

- A. The work of this Section is affected by unit prices specified in Division 01 Section "Unit Prices."
- B. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

1.04 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with a firm, natural balls of earth in which they are grown and placed, unbroken, in a container. The ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant indicated.
- D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of the container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant indicated.

- E. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- F. Finish Grade: Elevation of the finished surface of planting soil.
- G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- I. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: Surface or elevation of subsoil remaining after the excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- P. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- Q. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
- B. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
- C. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
 - 1. Qualification Data: For qualified landscape Installer. Include a list of similar projects completed by Installer demonstrating Installer's capabilities and

- experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
2. Product Certificates: For each type of manufactured product, from the manufacturer, and complying with the following:
 - D. Manufacturer's certified analysis of standard products.
 - E. Analysis of other materials by a recognized laboratory-made according to methods established by the Association of Official Analytical Chemists, where applicable.
 1. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before the start of the required maintenance periods.
 2. Warranty: Sample of special warranty.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in the successful establishment of plants.
- B. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
- C. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
- D. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site when work is in progress that is fluent in English.
- E. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Planet - Professional Landcare Network:
 1. Certified Landscape Technician - Exterior, with installation, maintenance, or irrigation specialty area(s), formerly CLT-E.
 2. Certified Landscape Industry Technician, formerly COLP.
- F. Pesticide Applicator: State licensed, commercial.
 1. Plant Material Quality - Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- G. All plants shall be freshly dug or well-rooted in containers. Rootballs shall be firm, intact and suitably sized.
- H. Where formal arrangements or symmetrically aligned plants are indicated to provide materials with uniform size and character.
- I. Provide well-formed healthy, vigorous stock grown under climatic conditions similar to the sites. Plants shall be free of damage, injury, defects, disease, insects, and disfigurements.
- J. Conifers shall have a single leader. Conifers that have ever been sheared are not acceptable.

1. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain the required sizes.
- K. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
- L. Other Plants: Measure with stems, petioles, and foliage in their normal position.
 1. Plant Material Observation: Architect may observe plant material either at the place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
- M. Notify Architect of sources of planting materials seven business days in advance of delivery to site.
 1. Retain paragraph below if the Work of this Section is extensive or complex enough to justify a preinstallation conference.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of the manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Bulk Materials:
- C. Do not dump or store bulk materials near structures, utilities, walkways, and pavements, or on existing turf areas or plants.
- D. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
- E. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
 1. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, windburn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
 2. Handle planting stock by the root ball.

- F. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
- G. Do not remove container-grown stock from containers before the time of planting.
- H. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not an overly-wet condition.
 - 1. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage and keep roots moist.
- I. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
- J. Do not remove container-grown stock from containers before the time of planting.
- K. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not an overly wet condition.

1.08 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
- C. Notify Construction Manager no fewer than five business days in advance of proposed interruption of each service or utility.
- D. Do not proceed with interruption of services or utilities without Owner's written permission.
 - 1. Planting Restrictions: Plant shall not be permitted during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from the date of Substantial Completion.
- E. Cold Weather: When the temperature is less than 32 degrees.
- F. Hot Weather: When the temperature is greater than 90 degrees.
- G. Wet Conditions: When planting area soils are soggy and saturated. Except in swale and pond areas.
- H. Windy Weather: When wind velocities are greater than 30 mph.
 - 1. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum

results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

2. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
- I. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.09 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within the specified warranty period.
- B. Failures include, but are not limited to, the following:
 1. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond the Contractor's control.
 2. Structural failures including plantings falling or blowing over.
 3. Faulty performance of tree stabilization and edgings,
 4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 5. Warranty Periods from Date of Substantial Completion:
- C. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
- D. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
- E. Include the following remedial actions as a minimum:
 1. Immediately remove dead plants and replace them unless required to plant in the succeeding planting season.
 2. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 3. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 4. Retain subparagraph below if required; revise to suit Project.
 5. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.10 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees, Shrubs, Vines, Ornamental Grasses, Ground Covers, Biennials, Perennials, and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
- B. Maintenance Period: 90 days from date of Substantial Completion.

1. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or another period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 PRODUCTS

2.01 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sunscald, injuries, abrasions, and disfigurement.
- B. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
- C. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
 1. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

2.02 MULCHES

- A. Organic Compost Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
- B. Dark Hemlock Bark – 3" depth
 1. Type: Hemlock
 2. Size: 5/8" dust
 3. Color: black

2.03 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.04 TREE STABILIZATION MATERIALS

- A. Stakes and Guys:
- B. Upright and Guy Stakes: Rough-sawn, sound, new softwood with specified without wood pressure-preservative treatment, free of knots, holes, cross-grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
- C. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inches in diameter.
- D. "VIT Cinch Tie" or Equivalent

2.05 MISCELLANEOUS PRODUCTS

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film-forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- B. Burlap: Non-synthetic, biodegradable.
- C. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb. (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb. (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
- B. All irrigation system components shall be installed, tested and in an acceptable working condition prior to planting.
- C. Verify that no foreign or deleterious material, trash or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
- D. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
- E. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
- F. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 2. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace it with new planting soil.

3.02 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Layout plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
- F. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
 - 1. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.03 PLANTING AREA ESTABLISHMENT

- A. Remove stones larger than 1 inch in any dimension and trash, debris sticks, roots, rubbish, and other extraneous matter and legally dispose of them off of the Owner's property.
- B. Finish Grade of planting areas to be smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions to meet finish grades.
- C. Before planting, obtain the Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.04 EXCAVATION FOR TREES AND SHRUBS

- A. Layout the individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required
- B. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that the root ball will sit

- on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
- C. Excavate approximately three times as wide as ball diameter for balled and burlapped, and container-grown, stock.
 - D. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - E. If an area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - F. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - G. Maintain supervision of excavations during working hours.
 - H. Keep excavations covered or otherwise protected after working hours or when unattended by Installer's personnel.
 - I. If drain tile is shown on Drawings or required underplanting areas, excavate to top of porous backfill over tile.
 - 1. Subsoil removed from excavations may not be used as planting soil.
 - 2. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
 - J. Hardpan Layer: Drill 6-inch diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
 - 1. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
 - 2. Fill excavations with water and allow it to percolate away before positioning trees and shrubs.

3.05 TREE, SHRUB, AND VINE PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled, burlapped and container-grown stock plumb and in center of planting pit or trench with root flare of Trees 2 inches and Shrubs and Vines 1 inch above adjacent finish grade of topsoil.
- D. Use planting soil for backfill.
- E. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove

from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.

- F. For container-grown stock carefully remove root ball from container without damaging root ball or plant.
- G. Place amended backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
- H. Continue backfilling process. Water again after placing and tamping final layer of amended soil.
 - 1. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.06 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.07 TREE STABILIZATION

- A. Install trunk stabilization as follows unless otherwise indicated:
- B. Upright Staking and Tying: Stake trees of 1-inch through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
- C. Use two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
- D. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.08 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on drawings in even rows with triangular spacing.

- B. Use amended planting soil for backfill.
- C. Dig holes large enough to allow the spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
- H. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- I. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.
- J. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- K. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.
- L. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
- M. Size: 21-gram tablets.
- N. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.
 - 1. Submittals - At least 14 working days in advance of construction, submit the following:
 - a. 1-gallon sample of the blended material.
 - b. Documentation for the three analyses described in section C (1.) (b.) of this specification (particle gradation with calculated coefficient of uniformity; organic matter content; pH). The analyses shall be performed by an accredited laboratory with certification maintained current. The date of the analyses shall be no more than 90 calendar days prior to the date of the submittal. The report shall include the following information:
 - c. Name and address of laboratory

- d. Phone contact and e-mail address for the laboratory.
 - 1) Test data, including the date and name of the test procedure
 - 2) A compost technical data sheet from the vendor of the compost.
The analysis and report must be consistent with the sampling and reporting requirements of the US Composting Council Seal of Testing Assurance (STA) program. The analysis shall be performed and reported by an approved independent STA program laboratory. The date of the analysis shall be no more than 90 calendar days prior to the date of the submittal.
 - 3) A description of the location, equipment, and method proposed to mix the material.

3.09 STORMWATER FACILITY PLANTING

- A. Protection of the Growing Medium - The growing medium shall be protected from all sources of contamination, including weed seeds, while at the supplier, in conveyance, and at the project site.
- B. Timing of Plant Installation - Weather permitting, plants shall be installed as soon as possible after placing and grading the growing medium in order to minimize erosion and further compaction.
- C. Erosion Control - Temporary erosion control measures are required until permanent stabilization measures are functional, including the protection of overflow structures.
- D. Protection of the Facility - In all cases, the facility must be protected from foot or equipment traffic that is unrelated to the construction of the facility. Temporary fencing or walkways should be installed as needed to keep workers, pedestrians, and equipment out of the facility. Under no circumstances should materials and equipment be stored in the facility. Stormwater facilities shall be kept clean and shall not be used as erosion and sediment control structures during construction.
- E. Wet and Winter Conditions - Placement of the growing medium will not be allowed when the ground is frozen or saturated or when the weather is determined to be too wet.
- F. All stormwater planting areas to be top-dressed with a 2" minimum depth of approved organic compost.
- G. Water all plants during establishment per following:
 - 1. Water deciduous trees 1-1/2 inches or larger and conifer trees over 4 feet in height as follows:

Time	Frequency	gallons/tree (minimum)
May - June	weekly	15
July - August	weekly	20
September - October	weekly	15

2. Water shrubs as follows:

Time	Frequency	Gallons/Shrub
May - June	weekly	5 - 10
July - August	weekly	15 - 20
September - October	weekly	10 - 15

3.10 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
- B. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 2 to 3-inch average thickness, with 18-inch radius around trunks or stems. Do not place mulch within 6 to 8 inches of trunks or stems.
- C. Organic Mulch in Planting Areas: Apply a 3-inch average thickness of approved mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 to 8 inches of trunks or stems.

3.11 EDGING INSTALLATION

- A. Wood/Composite Edging: Install edging where indicated. Miter cut joints and connections at a 45-degree angle. Fasten each cut joint or connection with two galvanized nails. Anchor with wood stakes spaced up to 36 inches apart, driven at least 1 inch below top elevation of edging. Use two galvanized nails per stake to fasten edging, of length as needed to penetrate both edging and stake and provide 1/2-inch clinch at point. Pre-drill stakes if needed to avoid splitting. Replace stakes that crack or split during installation process.
- B. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches apart, driven below top elevation of edging.
- C. Aluminum Edging: Install aluminum edging where indicated according to manufacturer's written instructions. Anchor with aluminum stakes spaced approximately 36 inches apart, driven below top elevation of edging.
- D. Shovel-Cut Edging: Separate mulched areas from turf areas with a 45-degree, 4 to 6-inch deep, shovel-cut edge as shown on Drawings.

3.12 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.13 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.14 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.15 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

**SECTION 32 9413
ROOT BARRIER**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnish all labor, material, equipment, related services and supervision necessary for or incidental to the installation of the tree root barriers as shown or indicated on the Drawings and/or as specified.
- B. Work Included:
 - 1. Tree root barriers, various depths and combinations may be required.

1.02 RELATED DOCUMENTS

- A. Irrigation - Section 32 84 00
- B. Plants - Section 32 93 00

1.03 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI)
- B. American Society for Testing Materials (ASTM)

1.04 DEFINITIONS

- A. Tree Root Barrier: Mechanical barrier and root deflector to prevent tree roots from damaging hardscapes and landscapes

1.05 SUBMITTALS

- A. Product data: Manufacturer's standard literature defining materials for use on this Project.
- B. Shop drawings:
 - 1. Indicate locations and extent for tree root barrier material.
- C. Samples:
 - 1. Tree root barrier: One full length panel.
- D. Quality control submittals; manufacturer's instructions: Complete installation instructions for each item specified; may be combined with product data.

1.06 QUALITY ASSURANCE

- A. Qualifications; manufacturer: Minimum 10 years experience in tree and plant protection and accessories.

1.07 DELIVERY STORAGE AND HANDLING

- A. Packing and shipping: Provide materials in original unopened containers with manufacturer's labels intact and legible.
- B. Acceptance at site:
 - 1. Damaged materials determined by visual inspection will not be accepted.
 - 2. Remove rejected materials from Project site immediately.
- C. Storage and protection: Store materials in dry area in manufacturer's protective packaging; in original containers with labels and instruction instructions intact.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturers
 - 1. Products specified as standard of quality are manufactured by DeepRoot Partners, L.P. (Deep Root); 81 Langton Street, Suite 4, San Francisco CA 94103; 415.437.9700; 800.458.7668; fax 800.277.7668; www.deeproot.com.
 - 2. Products of manufacturers meeting indicated standards and specified manufacturer's product data characteristics, are acceptable for use, subject to approval of product list and samples.

2.02 MANUFACTURED UNITS

- A. Tree root barriers
 - 1. 24 inch depth
 - a. Product standard of quality: DeepRoot; Tree Root Barriers; UB 24-2. Or approved equal.
 - b. Material: 0.080" wall thickness, nominal, injection molded 50% post-consumer recycled polypropylene panels with UV inhibitors.
 - c. Panel specifics
 - 1) 7/16" wide integral molded 0.080" thickness double top edge with stiffening ribs; bottom edge attached to vertical root deflecting ribs.
 - 2) Integral molded 0.080" thickness by 2" deep vertical root directing ribs spaced at 6" O.C.
 - 3) Integral molded 0.080" thickness by 2" long by 3/8" wide horizontal anti-lift ground lock tabs; minimum three per panel.
 - 4) Size: 24" wide by 24" deep.
 - 5) Preassembled joiner system for panel connection to adjacent panel.
 - 6) Color: Black.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions
 - 1. Verify other work in other sections, in, at, and around landscaping work is complete to extent that no damage will occur to newly planted materials or, any possible construction related damage will be minimal and replacement plant material is readily available for planting at no additional cost.
 - 2. Obtain verification, in writing, from work required in other Sections directly involving work in this Section regarding correct grades have been provided, coordination of topsoil spreading, and lawns and grasses planting.

3. Beginning work without fulfilling conditions below requiring removal or replanting work in this section becomes responsibility of this section.
4. Not providing written notification to Architect of unacceptable conditions indicates acceptance of site.
5. Not receiving verification indicated above.
6. Work required not indicated as unacceptable requiring removal or replanting work.

3.02 PREPARATION

- A. Surface protection: Use methods necessary to prevent damage to completed site work performed in other Sections. Protect access to and areas around planted materials. Restore damaged areas to original compaction, grades, and lines; repair damaged grassed areas.

3.03 INSTALLATION

- A. Tree root barriers: Install in accord with manufacturer's reviewed installation instructions where indicated on reviewed shop drawings with vertical root directing ribs facing inwards towards trees or plants; connect panels together as required.

END OF SECTION

SECTION 33 10 00**WATER SYSTEM****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Site water distribution system for domestic and fire protection services up to 5 feet of any on-site building being served.
- B. Domestic water and fire protection water transmission or distribution system within a roadway or street right-of-way.

1.2 RELATED SECTIONS

- A. Section 31 21 00, Utility Trenching and Backfill

1.3 RELATED DOCUMENTS

- A. ASME
 - 1. ASME A112.1.2: Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water Connect Receptors)
 - 2. ASME B1.20.1: Pipe Threads, General Purpose, Inch
 - 3. ASME B16.1: Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
 - 4. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings
 - 5. ASME B16.22: Wrought Copper and Copper Alloy Solder – Joint Pressure fittings
 - 6. ASME B16.26: Cast Copper Alloy Fittings for Flared Copper Tubes
- B. ASTM
 - 1. ASTM A536: Standard Specification for Ductile Iron Castings
 - 2. ASTM A674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
 - 3. ASTM B61: Standard Specification for Steam or Valve Bronze Castings
 - 4. ASTM B62: Standard Specification for Composition Bronze or Ounce Metal Castings
 - 5. ASTM B88: Standard Specification for Seamless Copper Water Tube
 - 6. ASTM C94: Standard Specification for Ready-Mixed Concrete
 - 7. ASTM D1785: Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 8. ASTM D2564: Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems
 - 9. ASTM F1056: Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings

- C. AWWA
1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
 3. C110: Ductile-Iron and Gray-Iron Fittings
 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
 6. C116: Protective Fusion-Bonded Epoxy Coatings for the Interior & Exterior Surfaces for Ductile-Iron and Gray-Iron Fittings
 7. C150: Thickness Design of Ductile-Iron Pipe
 8. C151: Ductile-Iron Pipe, Centrifugally Cast
 9. C153: Ductile-Iron Compact Fittings
 10. C200: Steel Water Pipe 6 inch and larger
 11. C203: Coal-Tar Protective Coatings and Linings for Steel Water Pipe
 12. C205: Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 inch and Larger-Shop Applied
 13. C207: Steel Pipe Flanges for Waterworks Service-Sizes 4 inch through 144 inch
 14. C208: Dimensions for Fabricated Steel Water Pipe Fittings
 15. C209: Cold Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings
 16. C210: Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
 17. C213: Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
 18. C214: Tape Coatings for Steel Water Pipelines
 19. C218: Liquid Coatings for Aboveground Steel Water Pipe and Fittings
 20. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
 21. C500: Metal-Seated Gate Valves for Water Supply Service
 22. C502: Dry-Barrel Fire Hydrants
 23. C503: Wet Barrel Fire Hydrants
 24. C504: Rubber Seated Butterfly Valves.
 25. C507: Ball Valves, 6 inch through 60 inch.
 26. C508: Swing-check Valves for Waterworks Service, 2 inch through 48 inch NPS.
 27. C509: Resilient-Seated Gate Valves for Water Supply Service
 28. C510: Double Check Valve Backflow Prevention Assembly
 29. C511: Reduced-Pressure Principle Backflow Prevention Assembly
 30. C512: Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
 31. C550: Protective Interior Coatings for Valves and Hydrants
 32. C600: Installation of Ductile-Iron Water Mains and Their Appurtenances
 33. C606: Grooved and Shouldered Joints
 34. C651: Disinfecting Water Mains
 35. C800: Underground Service Line Valves and Fittings
 36. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 60 inch for Water Transmission and Distribution
 37. C901: Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 inch for Water Service

- 38. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch through 48 inch for Water Transmission and Distribution
 - 39. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 65 inch, for Waterworks
 - 40. M11: Steel Pipe - A Guide for Design and Installation
 - 41. M23: PVC Pipe – Design and Installation
 - 42. M41: Ductile-Iron Pipe and Fittings
- D. Factory Mutual Insurance Company (FM)
 - 1. FM 1530: Fire Department Connections
 - E. National Fire Protection Association (NFPA)
 - 1. NFPA 24: Installation of Private Fire Service Mains and Their Appurtenances
 - 2. NFPA 70: National Electric Code
 - 3. NFPA 1963: Fire Hose Connection
 - F. National Sanitation Foundation (NSF)
 - 1. NSF 61: Drinking Water System Components-Health Effects
 - G. Underwriters Laboratory(UL)
 - 1. UL 262: Safety Gate Valves for Fire-Protection Service
 - 2. UL 405: Safety Fire Department Connection Devices
 - 3. UL 789: Indicator Posts for Fire-Protection Service

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing Materials
- C. AWWA: American Waterworks Association
- D. DI: Ductile iron
- E. DIP: Ductile iron pipe
- F. FM: Factory Mutual
- G. NFPA: National Fire Protection Association
- H. NSF: National Sanitation Foundation
- I. PCC: Portland cement concrete
- J. PE: Polyethylene
- K. PVC: Polyvinyl Chloride
- L. UL: Underwriters Laboratory

1.5 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Internal Pressures: As indicated on Plans. [Check if it is indicated on the plans, if not state it here.]
- B. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless indicated otherwise.

1.6 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Product Data: Manufacturer's literature and data, including, where applicable, sizes, pressure rating, rated capacity, listing/approval stamps, labels, or other marking on equipment made to the specified standards for materials, and settings of selected models, for the following: *[delete items not included in project]*
 - 1. Piping materials and fittings
 - 2. Gaskets, couplings, sleeves, and assembly bolts and nuts
 - 3. Flexible pipe fittings
 - 4. Restrained pipe fittings
 - 5. Flexible Connectors
 - 6. Expansion joints
 - 7. Flexible expansion joints
 - 8. High deflection fittings/ball joints
 - 9. Gate valves
 - 10. Butterfly valves
 - 11. Check valves
 - 12. Ball valves
 - 13. Air release, air/ vacuum and combination air valves
 - 14. Blow-off valves
 - 15. Pressure reducing valves
 - 16. Flow Regulating valves
 - 17. Service connections and water meters
 - 18. Valve boxes, meter boxes, frames and covers
 - 19. Backflow preventers
 - 20. Fire hydrants
 - 21. Post indicator valves
 - 22. Fire department connections
 - 23. Thrust block concrete mix
 - 24. Tapping sleeves and tapping valves
 - 25. Service saddles and corporation stops
 - 26. Identification materials and devices
- C. Shop Plans and Calculations: Where an on-site fire water system is required, Contractor shall provide shop plans for Engineer and agency approval prior to construction. Coordinate with the Plans and identify any proposed modifications or deviations. Shop

Plans and Calculations shall be stamped and signed by a registered Fire Protection Engineer licensed by the State of Oregon as required.

1. Include the following information:
 - a. Design assumptions
 - b. Thrust block sizing and calculations
 - c. Materials to be used
 - d. Available water pressure
 - e. Required water pressure
 2. The review of fire system components constitutes only a portion of the review and approval required. A copy of the fire system component submittal package shall be forwarded to the local fire marshal for further review and approval.
- D. Water Pressure Report *[check if needed]*: At the conclusion of work, the Contractor shall engage a qualified testing service to conduct a flow test of the existing system (providing flow test data for all mains and at least six (6) hydrants). Provide date and location of test, type and method of test performed, static pressure and residual pressure in psig, observed flow in gpm, and orifice size.
- E. Shop drawings: Include plans, elevations, details and attachments.
 1. Precast and cast in-place vaults and covers
 2. Wiring diagrams for alarm devices
- F. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

1.7 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.
- B. Comply with the following requirements and standards:
 1. NSF 61: "Drinking Water System Components-Health Effects" for materials for potable water.
 2. NFPA 24: "Installation of Private Fire Service Mains and Their Appurtenances" for materials, installations, tests, flushing, and valve and hydrant supervision.
 3. NFPA 70: "National Electric Code" for electrical connections between wiring and electrically operated devices.
- C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

1.8 MATERIAL DELIVERY, STORAGE AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 1. Ensure that valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.
- C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. During Storage: Use precautions for valves, including fire hydrants according to the following.
 1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
 2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- E. Do not store plastic pipe and fittings in direct sunlight.
- F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.
- G. Protect linings and coatings from damage.
- H. Handle precast boxes, vaults and other precast structures according to manufacturer's written instructions.
- I. Protect imported bedding and backfill material from contamination by other materials.

1.9 COORDINATION

- A. Coordinate connection to existing water mains with water utility supplying water.
- B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

PART 2 - PRODUCTS

2.1 COPPER PIPE: SIZES ¾ INCH THROUGH 2 INCH

- A. Pipe and Fittings: Provide Type K soft or hard copper pipe, seamless water tube, annealed conforming to ASTM B88.
- B. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18.
- C. Wrought copper solder-joint pressure fittings or wrought copper alloy unions shall conform to ASME B16.22

- D. Cast copper alloy flare fittings shall conform to ASME B16.26.
- E. Wrought copper alloy body, hexagonal stock, metal-to-metal seating surfaces, and solder-joint threaded ends shall conform to ASME B1.20.1.
- F. Compression connections shall be Mueller 110, Ford or approved equal.
- G. Joints: Restrain by couplings.

2.2 PE PLASTIC PIPE: SIZES ½ INCH THROUGH 3 INCH

- A. Pipe and Fittings: Provide PE3408, Pressure Class *[modify pipe class and DR per pipe design pressure and depth]* 200, DR 9 conforming to AWWA C901. PWPIPE, or approved equal.
- B. Cast Copper Fittings shall conform to ASME B16.18.
- C. Cast Copper Compression Fittings and connections shall be Mueller 110, Ford or approved equal.
- D. Joints: Restrain with clamps or heat-fusion.

2.3 PVC PIPE: SIZES 1/8 INCH THROUGH 3 INCH

- A. Pipe and Fittings: ASTM D1785, Schedule 40. [Schedule 80 and 120 are also available. Pressure ratings up to 260 psi are achievable with schedule 40]
- B. Joints: Restrain with solvent cement. Do not use threaded pipe.
- C. Solvent Cement: ASTM D2564.

2.4 DIP: SIZES 4 INCH THROUGH 48 INCH

- A. Pipe: Pressure Class *[insert class required based on design pressure]* pipe conforming to AWWA C151, AWWA Manual M41 and standard thickness per AWWA C150. U.S. Pipe, American Cast Iron Pipe Company, or approved equal.
- B. Fittings: Provide fittings with pressure rating greater than or equal to that of the adjoining pipe.
- C. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
- D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
- E. Fittings
 1. Standard: AWWA C110, sizes 4 inch through 48 inch.
 2. Compact: AWWA C153, sizes 4 inch through 24 inch.
 3. All fittings shall be fusion epoxy coated per AWWA C116.

- F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105. ***[Use only if soil conditions warrant, i.e. corrosive soils. Check geotechnical report]***
- G. Unrestrained Joints (Rubber Gasket Joints):
1. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111.
 2. Mechanical Joint: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.
- H. Restrained Joints:
1. Flanged Joint: ***[In general, use only in non-buried conditions, i.e. above grade or in a vault]*** Provide bolts, nuts, and gaskets in conformance with AWWA C115. Gaskets shall conform to the requirements specified in AWWA C111. Unless otherwise required, above ground flange assembly bolts shall be standard hex-head, cadmium plated machine bolts with American Standard Heavy, hot-pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts shall be as above except they shall be of Type 304 stainless steel.
 2. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111 with "Field Lok Gasket," sizes 4 inch through 24 inch, "TR Flex," sizes 4 inch through 64 inch; both by U. S. Pipe, or approved equal. "Megalug" restraint harness, EBAA Iron, or approved equal.
 3. Mechanical Joint: ***[Pressure rating of 350 psi for sizes 3 inch through 16 inch, and 250 psi for sizes 18 inch through 48 inch]*** Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111 with "Megalug," sizes 3 inch through 48 inch, EBAA Iron, or approved equal.
 4. Grooved and Shouldered Joints: AWWA C150, AWWA C151 and AWWA C606. 24 inch maximum size. ***[Use only for above grade piping]***
- I. Insulating Joints:
1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
 2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
 3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
 4. Provide bolts and nuts as recommended in AWWA C115.
- J. Couplings: [check with manufacturer for sizes and pressure rating available]
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. ***[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]*** Smith-Blair, Inc., Dresser, or approved equal. ***[Specify anchor studs or locking pins at locations where joints must be restrained.]***

2. Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. *[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]* Smith-Blair, Inc., Dresser, or approved equal. *[Specify anchor studs or locking pins at locations where joints must be restrained.];* or 2) restrained flange adapter, "Megaflange," sizes 3 inch through 48 inch, EBAA Iron, or approved equal.

2.5 PE PIPE: SIZES 4 INCH THROUGH 64 INCH

- A. Pipe and Fittings: AWWA C906
- B. Joints:
 1. Thermal Butt Fusion: AWWA C906 and pipe manufacturer's recommendations
 2. Flanged joints: AWWA C906 and pipe manufacturer's recommendations

2.6 PVC PIPE: SIZES 4 INCH THROUGH 48 INCH

- A. Pipe: Pressure *[modify pipe class and DR per pipe design pressure and depth]* Class 200, DR 14, spigot and gasket bell end, conforming to AWWA C900 (4 inch through 12 inch and AWWA C905 (14 inch through 48 inch)
- B. Fittings: Ductile iron fittings
 1. Standard: AWWA C110, sizes 4 inch through 48 inch
 2. Compact: AWWA C153, sizes 4 inch through 24 inch
 3. All fittings shall be fusion epoxy coated per AWWA C116
- C. Unrestrained Joints: Push-On Bell and Spigot Joint: AWWA C900
- D. Restrained Joints:
 1. Push-On Bell and Spigot Joint: Harness assembly as manufactured by EBAA Iron, or approved equal. *[Check with the manufacturer for sizes, pressure ratings and corrosion protection coatings that are available.]*
 2. Plain End PVC to Ductile Iron Mechanical Joint: EBAA Iron, or approved equal.
- E. Steel or Ductile Iron Couplings: [check with manufacturer for sizes and pressure rating available]
 1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. *[Stainless steel bolts and nuts and special coatings available for extra protection from corrosion.]* Smith-Blair, Inc., Dresser, or approved equal. *[Specify anchor studs or locking pins at locations where joints must be restrained.]*
 2. Plain End Pipe to Ductile Iron or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. *[Stainless steel bolts and nuts and special coatings available for extra protection*

from corrosion.] Smith-Blair, Inc, Dresser or approved equal. [Specify anchor studs or locking pins at locations where joints must be restrained.]

- F. PVC Couplings: [check with manufacturer for sizes and pressure rating available]
 - 1. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by North American Piper approved equal. *[Couplings for joint deflections up to 5 degrees are available.]*
 - 2. Restrained Plain End to Plain End Pipe: AWWA C900, "Fluid-Tite" as manufactured by North American Pipe, or approved equal.

2.7 CEMENT MORTAR LINED AND COATED STEEL PIPE: 6 INCH AND LARGER

- A. Pipe: AWWA C200 and AWWA M11
- B. Special Sections and Fittings: AWWA C200, C207, C208 and AWWA M11 for all bends, tees, nozzles, closures, etc.
- C. Flanges: AWWA C207. Includes blind flanges.
- D. Linings and Coatings for Pipe, Special Sections and Fittings: Cement Mortar Lining and Coating: AWWA C205. [Other linings and coatings are available. Consult the following AWWA Standards and pipe manufacturers such, as Ameron, for details.
- E. Non-Restrained Joints: AWWA M11 - Rubber Gasket: Carnegie-shape rubber gasket as indicated
- F. Restrained Joints: AWWA M11. Where a flanged joint, butt strap or coupling are not indicated, either restrained joint a, or b, as follows, is acceptable, but the selected joint shall be used throughout the project.
 - 1. Rubber Gasket: Carnegie-shape rubber gasket with field welded restraint bar as indicated
 - 2. Field Lap Welded Slip Joint: As indicated
 - 3. Field Welded Butt Strap: As indicated
 - 4. Flanged Joint: AWWA C207 with Type 316L stainless steel bolts and nuts as indicated
- G. Joint Coating for Cement Mortar Lined and Coated Steel Pipe:
 - 1. Field Joint Encasement: Cement mortar contained in fabric lined with closed cell polyethylene foam as indicated. Attach fabric to pipe with Type 316L stainless steel straps as indicated. Closed cell polyethylene foam encasement shall be by Industrial Specialties or approved equal.
- H. Non-Restrained Flexible Couplings: AWWA C219, Smith Blair, Inc., Number 411 or approved equal, with factory applied fusion-bond epoxy coating and Type 316L stainless steel bolts and nuts.
- I. Restrained Flexible Couplings: Non-restrained flexible coupling supplemented with a restraining harness as indicated and as follows:

1. Restraining harness design by Contractor's pipe manufacturer using criteria presented in AWWA M11.
 2. Space harness-lugs and tie bolts equally around the pipe.
 3. Type 316L stainless steel harness tie bolts and nuts.
 4. Design and dimensions of harness lugs to be modified from that shown in AWWA M11, as necessary, to provide additional height to clear the coupling.
- J. Field Coating of Coupling Assemblies: Apply either of the following flexible tape and mastic or putty coating systems to the all non-restrained or restrained flexible steel couplings.
1. Denso Coating System – Denso North American, Inc.
 2. Trenton Coating System – Trenton Corporation

2.8 FLEXIBLE CONNECTORS [CHECK WITH THE MANUFACTURER TO DETERMINE THE PIPE MATERIALS TO WHICH THE FOLLOWING FITTINGS MAY BE JOINED.]

- A. Flanged Coupling Adapters for plain end pipe at fittings, valves and equipment shall be Dresser Style 127 or 128, similar models by ITT; Baker Coupling Company or approved equal. Nuts, bolts and other hardware shall be Type 304 stainless steel.
- B. Mechanical Couplings shall be rated for a minimum working pressure of 150 psi. The barrel shall be a minimum 10 inches long. Couplings shall be cleaned and shop primed with manufacturer's standard rust inhibitive primer. Mechanical couplings shall be Smith-Blair, Romac, JCM, Apac or approved equal, with stainless steel nuts, bolts, and threaded rods.
- C. Flexible Coupling for Steel Pipe shall be Dresser Coupling Style 38 with EPDM gaskets, or approved equal.

2.9 EXPANSION JOINT [CHECK WITH THE MANUFACTURER TO DETERMINE THE PIPE MATERIALS TO WHICH THE FOLLOWING FITTINGS MAY BE JOINED.]

- A. An expansion joint shall be installed at location indicated on the Plans and shall be manufactured of ductile iron conforming to the material properties of AWWA C153.
- B. Separation beyond the maximum extension of the expansion joint shall be prevented without the use of external tie rods.
- C. The expansion joint shall be pressure tested against its own restraint to a minimum of 250 psi.
- D. All pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy, conforming to the applicable requirements of AWWA C213, and shall be tested with a 1500 volt spark test conforming to stated specification.
- E. Mechanical or Flanged Joint: The expansion joint shall be Model Ex-Tend 200, 4 inch through 36 inch, as manufactured by EBAA Iron, Inc., or approved equal. **[WARNING DO NOT USE THE EX-TEND EXPANSION JOINT WITH A FORCE BALANCED**

FLEXTEND. THE FORCE IMBALANCE WILL CAUSE THE EXTEND TO MOVE. USE A STANDARD FLEXTEND INSTEAD].

- F. TR Flex Joints: TR Flex Telescoping Sleeve, 4 inch through 64 inch, U. S. Pipe.

2.10 FLEXIBLE EXPANSION JOINTS [CHECK WITH THE MANUFACTURER TO DETERMINE THE PIPE MATERIALS TO WHICH THE FOLLOWING FITTINGS MAY BE JOINED.]

- A. Flexible expansion joints shall be installed at locations indicated on the Plans and shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and AWWA C153.
- B. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 250 psi. A minimum 2:1 safety factor, determined from the published pressure rating, shall apply.
- C. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of 15°, and 6 inches minimum expansion. The flexible expansion fitting shall not expand or exert an axial imparting thrust under internal water pressure. The flexible expansion fitting shall not increase or decrease the internal water volume as the unit expands or contracts.
- D. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.
- E. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C116
- F. Polyethylene sleeves, meeting AWWA C105, shall be included for direct buried applications.
- G. Flanged or mechanical Joint: Flexible expansion joint shall be Force Balanced FLEXTEND, sizes 3 inch through 48 inch, as manufactured by EBAA Iron, or approved equal. ***[WARNING DO NOT USE THE EX-TEND EXPANSION JOINT WITH A FORCE BALANCED FLEXTEND. THE FORCE IMBALANCE WILL CAUSE THE EXTEND TO MOVE. USE A STANDARD FLEXTEND INSTEAD].***
- H. Flanged Joint: Starflex, Series 5000, Star Pipe Products, or approved equal.
- I. Plain End to Plain End Pipe: "Xtra Flex," sizes 4 inch through 24 inch, U. S. Pipe, or approved equal.

2.11 HIGH DEFLECTION FITTINGS/BALL JOINTS

- A. Plain End Pipe: Xtra Flex Restrained Joint High Deflection Fittings, 4 inch through 24 inch, U. S. Pipe, or approved equal.
- B. Mechanical or Flanged Joint: Flex 900, 4 inch through 12 inch, EBAA Iron, or approved equal.

2.12 GATE VALVES

- A. Provide valves conforming to AWWA C500 or AWWA C509
- B. Valves shall be resilient-seated, with non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise.
- C. [Metal seated, AWWA C500, and rubber seated, AWWA C504, are also available.]
- D. All bolts, nuts and washers, except operating nut, shall be stainless steel.
- E. Stem operating nut to be 2 inches square and open counter-clockwise.
- F. Stem extensions shall be installed to bring the stem operating nut to within 2 feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4 feet.
- G. Equip valves in pump stations and other interior or vault installations with hand-wheels. *[Verify this with the system owner].*
- H. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- I. For the domestic water system, valves shall also conform to NSF 61.
- J. Service valve Valves and fittings, 2 inch and smaller shall be in accordance with AWWA C800
- K. Where a post indicator is shown, provide valve with an indicator post flange.
- L. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
 - 1. Mueller Company
 - 2. M&H Valve Company
 - 3. Crane Company, or approved equal

2.13 BUTTERFLY VALVES

- A. AWWA C504, rubber seated, Class 150B cast iron body, cast or ductile iron discs, stainless steel shafts, adjustable field replaceable rubber seats mating against stainless steel seat rings and field-replaceable seals.
- B. Flanged or mechanical joint end connections.
- C. No wafer type valves allowed.
- D. Traveling nut type valve actuators designed for buried service unless noted otherwise. *[Check if valve is automated or not. If not delete this paragraph]*
- E. All bolts, nuts and washers, except wrench nut, shall be stainless steel.
- F. Wrench nut to be 2 inches square and open counter-clockwise.
- G. Stem extensions shall be installed to bring the wrench nut to within 2 feet of finish grade where the depth from finish grade to the wrench nut exceeds 4 feet.
- H. Equip valves in pump stations and other interior or vault installations with hand-wheels. *[Verify this with the system owner]*
- I. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Mueller Company
 - 2. M&H Valve Company
 - 3. Crane Company, or approved equal

2.14 SWING CHECK VALVES

- A. Provide swing-check type valves conforming to AWWA C508.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Mueller Company
 - 2. M&H Valve Company
 - 3. DeZurik/APCO
 - 4. Watts, or approved equal

2.15 BALL VALVES

- A. Provide ball valves (6 inch through 48 inch) per AWWA C507 as manufactured by Crane Company, or approved equal.
- B. Provide ball valves (2 inches and smaller) conforming to AWWA C800 as manufactured by Mueller 300 Series, Ford, or approved equal.
- C. Valves shall open by counterclockwise rotation of the valve stem.
- D. Provide valves with ends as appropriate for the adjoining pipe.
- E. Provide valve with lockable operating nut or handle as shown on the Plans.

2.16 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES

- A. Air release and vacuum valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin, DeZurik/APCO or approved equal.
- B. Combination air valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve or double valve body, and shall conform to AWWA C512. A simple or compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
 - 1. Crispin
 - 2. DeZurik/APCO, or approved equal

2.17 BLOW-OFF VALVES

- A. Provide valve and service size as shown in the Plans. Provide 2 inch valves at low points of the piping system, and 4 inch valves at dead-ends of the piping system, unless otherwise directed by the Engineer.
- B. 2 inch blow-off shall have a 2 inch vertical female iron pipe (FIP) inlet and a 2 inch normal pressure and temperature (NPT) nozzle outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16 inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF550, or approved equal.
- C. 4 inch blow-off shall have all brass principal working parts, 4 inch inlet and outlet and is self-draining and non-freezing. Valve shall open by counterclockwise rotation of a

top-mounted 2 inch square operating nut. All working parts shall be serviceable without excavation.

- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
- E. Kupferle/ MainGuard #7600, or approved equal

2.18 PRESSURE-REDUCING VALVES

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure [*check working pressure for system*], bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment.
- B. Valves shall have flanged ends. Valves sized 3 inches or smaller may have screwed ends.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Cla-Val Company
 - 2. Bermad
 - 3. Ames Company, or approved equal

2.19 FLOW-REGULATING VALVES

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment. Details as indicated.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Cla-Val Company
 - 2. Bermad
 - 3. Ames Company, or approved equal

2.20 SERVICE CONNECTIONS AND WATER METERS

- A. Service connections and water meter details and boxes as indicated.

2.21 VALVE BOXES, METER BOXES, FRAMES AND COVERS

- A. Water Valve Box: Provide pre-cast concrete valve box for each buried valve. Provide box with steel or cast iron traffic cover marked "WATER". Christy Model G5 with G5C cover or approved equal.

- B. Valve or Meter Boxes: Contractor shall verify box size required for water system appurtenances as shown in the Construction Documents. Provide a precast concrete utility box for each buried appurtenance. Provide a traffic-rated lid for H2O loading. A non-traffic rated lid may be used for boxes located in landscape areas. Christy, or approved equal.

2.22 BACKFLOW PREVENTER - REDUCED PRESSURE PRINCIPLE ASSEMBLIES (RPPA)

- A. Provide RPPA consisting of two independently operating check valves with a pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. RPPA shall be tamper-proof and conform to AWWA C511. Valve shall have an outside screw (OS) gate valve on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application.
- B. Body:
1. 2 inch and Smaller: Bronze with threaded ends
 2. 2 ½ inch and Larger: Bronze, cast iron steel, or stainless steel with flanged ends
- C. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies
- D. Interior Components: Corrosion-resistant materials
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
 2. Ames Company
 3. Febco, CMB Industries, Inc.
 4. Hersey Products, Inc.
 5. Watts
 6. Zurn/Wilkins, or approved equal

2.23 BACKFLOW PREVENTER - DOUBLE CHECK DETECTOR ASSEMBLY (DCDA)

- A. Provide a cast-iron body DCDA consisting of mainline double check assemblies in parallel with a bypass double check and meter assembly, two shut-off valves and four test cocks. DCDA shall be tamper-proof and conform to AWWA C510. FM approved or UL listed, with outside screw and yoke (OS&Y) gate valve on inlet and outlet, and strainer on inlet. Include two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
 2. Ames Company

3. Febco, CMB Industries, Inc.
4. Hersey Products, Inc.
5. Zurn/Wilkins, or approved equal

2.24 POST INDICATOR VALVE

- A. General: UL 789, FM approved, vertical-type, cast-iron body with operating wrench extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve. ***[Review fire department connection with agency having jurisdiction. Check hose threads and all sizes with fire department.]***
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. Mueller Company
 2. Clow Corporation
 3. American Cast Iron Company

2.25 FIRE DEPARTMENT CONNECTION

- A. Exposed, sidewalk or Freestanding Type Fire Department Connection: UL 405, cast brass body with threaded inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets and chains; lugged swivel connections and drop clapper for each hose-connection inlet; 18 inch high brass sleeve; and round escutcheon plate. Number of inlets shall be as shown on the Plans. Clapper and spring check inlets shall each have a minimum capacity of 250 gpm ***[check capacity required]***, and be furnished with a cap and chain. Outlet shall be sized for simultaneous use of all inlets. Connection shall be branded "Building XX".
 1. 2-Way FDC: Connection shall conform to UL 405 or FM 1530. Elkhart, Croker, or approved equal.
 2. 3-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Elkhart, Croker, Potter-Roemer or approved equal.
 3. 4-Way FDC: Connection shall conform to UL 405. Potter-Roemer, Croker, or approved equal.
 4. 6-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Croker, Potter-Roemer or approved equal.

2.26 FIRE HYDRANTS

- A. Provide two 2 ½ inch and one 4 ½ inch outlets, with a 6 inch nominal inside diameter inlet and break-away type bolts. Hydrant shall have a working pressure of 250 psi and shall conform to AWWA C502 ***[dry barrel to be used in areas where freezing temperatures encountered]*** or C503 ***[wet barrel to be used in areas ere freezing temperatures not encountered]***, and be UL listed and FM approved. Provide hydrants of one manufacturer. Clow model 960 series or approved equivalent, subject to approval of the Owner and fire marshal.

2.27 THRUST BLOCKS

- A. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 ½ parts sand, and 5 parts gravel, having the same minimum compressive strength.
- B. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.
- C. Where depth or location of existing structures prohibit the use of standard thrust blocks, gravity blocks may be used.

2.28 TAPPING SLEEVES AND TAPPING VALVES

- A. Tapping sleeves shall be epoxy coated and furnished with stainless steel washers, nuts and bolts. Mueller H-615 and H-619, Ford, or approved equal.
- B. Tapping valves shall have flanged inlet, Class 125 *[check class required based on design pressure]*, conforming to ASME B16.1 and furnished with stainless steel washers, nuts and bolts. Tapping valves shall be constructed with a mechanical joint outlet. Mueller T-687, T-642, T-681, or approved equal.

2.29 SERVICE SADDLES AND CORPORATION STOPS

- A. Service Saddles: Saddles shall conform to AWWA C800 and NSF 61.
 - 1. For DIP: Provide bronze or stainless steel body, double strap type with a 200 psi *[check pressure required based on design pressure]*, maximum working pressure. Mueller BR2 Series, Ford, or approved equal.
 - 2. For PVC: Provide bronze body, wide strap type. Mueller H-13000 Series, Ford, or approved equal.
 - 3. For PE: Per manufacturer's recommendations.
- B. Corporation Stops: Provide ground key type; bronze conforming to ASTM B61 or ASTM B62, for a working pressure of 100 psi and suitable for the working pressure of the system.
 - 1. Ends shall be suitable for adjoining pipe and connections, solder-joint, or flared tube compression type joint.
 - 2. Threaded ends shall conform to AWWA C800.
 - 3. Coupling nut for connection to flared copper tubing shall conform to ASME B16.26.
 - 4. Mueller H-15000 Series with "CC" threads and a copper flare straight connection outlet, Ford, or approved equal.

2.30 IDENTIFICATION MATERIALS AND DEVICES

- A. Warning Tape: Provide warning tape consisting of metallic foil bonded to solid blue plastic film not less than 3 inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1 mil thick. The tape continuously shall have printed

black-letter, not less than $\frac{3}{4}$ inch high, message reading "CAUTION: WATER MAIN BELOW".

- B. Tracer Wire for Nonmetallic Piping: Provide 12 guage, coated copper or aluminum wire not less than 0.10 inch in diameter, with blue THW, THWN, or THHN rated insulation, in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) shown on the Plans.
- B. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00 – Utility Trenching and Backfill.
- C. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- D. Pipe laying and jointing:
1. Provide proper facilities for lowering sections of pipe into trenches.
 2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
 3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
 5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
 6. Support pipe at proper elevation and grade.
 7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
 8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 9. Provide anchors and supports where indicated and where necessary for fastening work into place.
 10. Make proper provision for expansion and contraction of pipelines.
 11. Keep trenches free of water until joints have been properly made.
 12. Do not lay pipe when conditions of trench or weather prevent proper installation.
 13. All fittings shall be blocked with appropriately sized thrust blocks as shown on the Plans.
- E. Installation of Tracer Wire:

1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
 3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
 4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.
- F. Installation of Warning Tape
1. Install tape approximately 1 foot above and along the centerline of the pipe.
 2. Where tape is not continuous, lap tape ends a minimum of 2 feet.
- G. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- H. Connections to Existing Lines:
1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
 2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.
- I. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.2 INSTALLATION OF DUCTILE-IRON PIPING

- A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.
- B. Jointing:
1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
 2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
 3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.

4. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
 5. Align bolt holes for each flanged joint.
 6. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
 7. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.
 8. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
 9. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the setscrewed flange manufacturer.
 10. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.
 11. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.
- C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 8 mil linear low-density polyethylene (LLD) film or 4 mil high-density cross-laminated (HDCL) film per manufacturer's recommendations and in accordance with AWWA/ANSI C105/A21.5 and ASTM A674.
- D. Pipe Anchorage: Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.3 INSTALLATION OF POLYVINYL CHLORIDE PIPING

- A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA Manual M23.
- B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.
- C. Jointing:
1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
 2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
 3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.

5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
 6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
 7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- D. Pipe Anchorage:
1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.4 INSTALLATION OF POLYETHYLENE PIPING

- A. Install pipe, fittings, and appurtenances in accordance with manufacturer's recommendations.
- B. Jointing:
1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
 2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
 3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.
 4. Butt fusion:
 - a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
 - b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
 - c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
 - d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
 - e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the manufacturer's recommendations for temperature, pressure, holding, and cooling times.
 - f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.
 5. Socket fusion:

- a. Mixing manufacturers' heating tools and depth gauges will not be allowed unless the tools conform to ASTM F1056.
 - b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
 - c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
 - d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
 - e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
 - f. Simultaneously remove the pipe and fitting from the tool.
 - g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
 - h. Hold or block the pipe in place during cooling.
6. Electrofusion:
- a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
 - b. Clamp the pipe and fitting at the proper position in the fixture.
 - c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
 - d. Allow the joint to cool before removing the clamping fixtures.

3.5 INSTALLATION OF VALVES

- A. Gate Valves
1. Install gate valves conforming to AWWA C500 and UL 262 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, operation, and Maintenance of Gate Valves) to AWWA C509.
 2. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509.
 3. Install gate valves on PVC water mains in addition in accordance with the recommendations for appurtenance installation in AWWA Manual M23.
- B. Butterfly Valves: Install butterfly valves in accordance with the applicable requirements of Appendix A of AWWA C504.
- C. Check Valves: Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.

- D. Joints:
1. Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.
 2. Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

3.6 INSTALLATION OF VALVE AND METER BOXES

- A. Boxes shall be centered over the appurtenance so as not to transmit shock or stress. Covers shall be set flush with the surface of the finished pavement, or as shown on the Plans. Backfill shall be placed around the boxes and compacted to the specified level in a manner that will not damage or displace the box from proper alignment or grade. Misaligned boxes shall be excavated, plumbed, and backfilled at no additional cost to the Owner.

3.7 INSTALLATION OF FIRE HYDRANTS

- A. Install fire hydrants, except for metal harness, plumbed vertical, in accordance with AWWA C600 for hydrant installation and as indicated.
- B. Provide and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Hydrants shall be set so that mounting bolts clear the top of finished grade by three inches so bolts may be easily replaced if needed.
- C. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.

3.8 SERVICE LINE CONNECTIONS TO WATER MAINS

- A. Connect service lines of size shown on plans to the main with a rigid connection or a corporation stop and gooseneck. Install a gate valve on the service line.
- B. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.
- C. Connect service lines to PVC plastic water mains in accordance with the recommendations of AWWA Manual M23.

3.9 INSTALLATION OF BACKFLOW PREVENTERS

- A. Backflow devices shall be installed horizontal and level, with three feet minimum clearances from obstructions.

3.10 ANCHORAGE INSTALLATION

- A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.

- B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24 hours curing time before introducing water into the pipeline and allow a minimum of 7 days curing time before pressure testing.

3.11 CONNECTION TO EXISTING

- A. Contractor shall submit a work plan delineating the work sequence and duration of each task.
- B. The Contractor to submit a contingency plan in case work extends beyond the allowable shutdown duration
- C. The total allowed duration of shutdown shall not exceed **xxx [enter duration]**. Any day exceeding this period will accrue liquidated damages of **\$XXX [enter amount]** per day.
- D. Contractor to notify Owner 48 hours prior to shutdown.
- E. Prior to shutdown the Contractor shall have the following:
 - 1. Approved submittals for the work to be done
 - 2. Approved work plan
 - 3. Approved contingency plan
 - 4. The material, tools and equipment necessary to do the work, including pumps, generator, lighting, etc.
- F. No work shall be done within two weeks from a wet weather event.
- G. Contractor to check the weather (NOAA website) and plan work during dry weather period.

3.12 HYDROSTATIC PRESSURE AND LEAKAGE TEST

- A. General:
 - 1. Provide all necessary materials and equipment, including water.
 - 2. Backfill all trenches sufficient to hold pipe firmly in position.
 - 3. Allow time for thrust blocks to cure prior to testing.
 - 4. Flush all pipes prior to testing to remove all foreign material.
 - 5. Perform pressure and leakage test concurrently.
 - 6. Apply test pressure by means of a pump connected to the pipe.
 - 7. Base test pressure on the elevation of the lowest point in the line.
 - 8. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
 - 9. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.

10. The pressure test on mortar-lined pipe shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption in the cement mortar lining.
 11. Allow the system to stabilize at the test pressure before conducting the leakage test.
 12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
 13. Maintain test pressure as specified for type of pipe being tested.
 14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
 15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.
- B. Preparation for Test
1. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
 2. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
 3. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.
 4. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.
 5. A joint previously tested in accordance with this specification may be covered or insulated.
 6. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
 7. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.
- C. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
 3. No piping will be accepted if the leakage is greater than that determined by the following formula:
- $$L = (S \times D \times P^{1/2}) / 133,200$$
- L = Allowable leakage, gallons per hour.
S = Length of pipe tested, feet.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

D. PE Pipe Leakage Test:

1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
3. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for four hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.

Nominal Pipe Size (in.) Test	Allowance for Expansion (U.S. Gals./100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

- E. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
 3. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P^{1/2}) / 7,400$$

L = Allowable leakage, gallons per hour.

N = Number of joints in the length of the pipeline tested.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

- F. Cement Mortar Lined and Coated Steel Pipe Leakage Test: Perform in accordance with AWWA M11. Selected requirements of AWWA M11 are repeated as follows:
1. All pipelines shall be tested by subjecting each section to a pressure, measured at the lowest end of the section, of at least 150 percent of the class rating or design pressure of the pipe under test. In no case shall the pipe be tested at less than 150 psi, nor shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
 3. There shall be no significant leakage for pipe with welded joints or mechanical couplings.
 4. For pipe joined with O-ring rubber gaskets, a leakage of 25 gallons per inch of diameter per mile per 24 hours is allowed.

3.13 CLEANING

- A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Owner will examine the pipes for leaks. If any further defective pipes or joints are discovered, the Contractor shall repair them. Finished paving shall not be installed prior to completion of all cleaning and testing.

3.14 DISINFECTION OF PIPELINES

- A. After completion of the hydrostatic test, the mains shall be thoroughly flushed with a minimum pipe velocity of 2.5 fps and chlorinated in accordance with the latest revision of AWWA 651, Standards of Disinfecting Water Mains. Any one of the methods therein

described may be used, with the additional requirement of 50 ppm chlorination minimum initial application. At the end of the contact period, the mains shall again be flushed, and bacteriological samples taken.

- B. If necessary, the Contractor shall provide, at his expense, outlets from which to take the samples. The location of the chlorination and sampling points will be determined by the Owner in the field. Taps for chlorination and sampling shall be installed. The Contractor shall uncover and backfill the taps as required.
- C. Disinfection of tie-ins shall be performed by the Contractor by swabbing with chlorine or by other approved methods. Following a tie-in, the area affected by the tie-in shall be thoroughly flushed and bacteriological samples will be taken as deemed necessary.
- D. All treated water flushed from the lines shall be dechlorinated and disposed of by discharging to the locations identified in the Plans, or by other approved means. No discharge of chlorinated water to any storm sewer or natural water course will be allowed, unless properly dechlorinated.
- E. The Contractor shall rechlorinate and retest any lines that do not meet the requirements of the above testing. The line shall not be placed in service until the requirements of the State Public Health Department are met.

3.15 BACTERIOLOGICAL TESTING

- A. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory approved by the Owner.
- B. Water samples are to be taken at representative points no less than one test per 500 feet of pipe, plus one test at each end of the pipe; or as required by the Owner.
- C. After the samples have passed the bacteriological testing, the Contractor will be notified and arrangements can be made to make tie-ins and connections to house services.
- D. Each water sample will have passed the bacteria tests if they show zero total coliform per 100 ml and not more than 50 non-shoen bacteria per 100 ml, and when the turbidity is no greater than the source water.
- E. Samples shall be taken no sooner than 24 hours after final flushing.
- F. Jumpers and/or plates shall be pulled within 14 days of the notification of a successful test, or new bacteria samples will have to be taken.
- G. Follow-up bacteriological testing shall take place after tie-ins have been made, and shall meet the same passing requirements as the initial tests.

END OF SECTION

SECTION 33 30 00**SANITARY SEWER SYSTEM****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Sanitary gravity sewers and force mains up to five feet from any on-site building

1.2 RELATED SECTIONS

- A. Section 31 21 00, Utility Trenching and Backfill
- B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. AASHTO
 - 1. M199: Standard Specification for Precast Reinforced Concrete Manhole Sections
 - 2. M252: Standard Specification for Corrugated Polyethylene Drainage Pipe
 - 3. M294: Standard Specification for Corrugated Polyethylene Pipe, 12 to 60 inch Diameter
- B. ASTM
 - 1. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. ASTM A674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
 - 3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
 - 4. C443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - 5. C478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
 - 6. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 - 7. C1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems
 - 8. C1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
 - 9. D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
 - 10. D3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 11. D4101: Standard Specification for Propylene Injection and Extrusion Materials
 - 12. F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

13. F679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
 14. ASTM F1056: Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings
 15. F1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings
- C. AWWA
1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
 3. C110: Ductile-Iron and Gray-Iron Fittings
 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 5. C115: Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
 6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
 7. C150: Thickness design of Ductile Iron Pipe
 8. C151: Ductile-Iron Pipe, Centrifugally Cast
 9. C153: Ductile-Iron Compact Fittings
 10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
 11. C512: Air Release , Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
 12. C600: Installation of Ductile-Iron Water Mains and Their Appurtenances.
 13. C606: Grooved and Shouldered Joints
 14. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. for Water Transmission and Distribution
 15. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. for Water Transmission and Distribution
 16. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. for Waterworks
 17. M23: PVC Pipe – Design and Installation
 18. M41: Ductile Iron Pipe and Fittings
- D. Federal Specification
1. SS-S-00210 (GSA-FSS)
- E. Oregon Standard Specifications for Construction, current edition.

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing Materials
- C. AWWA: American Water Works Association
- D. OSSC: Oregon Standard Specifications for Construction
- E. HDPE: High-density polyethylene

- F. PE: Polyethylene
- G. DIP: Ductile iron pipe
- H. PVC: Polyvinyl Chloride
- I. RCP: Reinforced concrete pipe
- J. NPS: Nominal pipe size

1.5 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Product data for the following:
 - 1. Piping materials and fittings
 - 2. Special pipe couplings
 - 3. Joint sealants
 - 4. Cleanout plugs or caps
 - 5. Sewage air relief valves
- C. Shop drawings: Include plans, elevations, details and attachments for the following:
 - 1. Precast concrete manholes, frames and covers
 - 2. Precast concrete clean out boxes and box covers
 - 3. Force main piping access openings
- D. Design Mix Reports and Calculations: For each class of cast in place concrete
- E. Field Test Reports: Indicate test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage
 - 1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
 - 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling
 - 1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.
3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 DIP PIPE AND FITTINGS: SIZES 4 INCH THROUGH 48 INCH

- A. Pipe: Pressure Class *[insert class required based on design pressure]* pipe conforming to AWWA C151 and standard thickness per AWWA C150. U.S. Pipe, American Cast Iron Pipe Company, or approved equivalent
- B. Fittings: Provide fittings with pressure rating greater than or equal to that of the adjoining pipe.
- C. Pipe and Fitting Lining: Cement Mortar, AWWA C104. Use Type II or V cement for mortar lining.
- D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115
- E. Fittings
 1. Standard: AWWA C110, sizes 4 inch through 48 inch
 2. Compact: AWWA C153, sizes 4 inch through 24 inch
 3. All fittings shall be fusion epoxy coated per AWWA C116
- F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
- G. Unrestrained Joints (Rubber Gasket Joints):
 1. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111.
 2. Mechanical Joint: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.
- H. Insulating Joints:
 1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
 2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
 3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
 4. Provide bolts and nuts as recommended in AWWA C115.
- I. Couplings: [check with manufacturer for sizes and pressure rating available]
 1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Smith-Blair, Inc., Dresser, or approved equal.

2. Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Smith-Blair, Inc., Dresser, or approved equal or 2) restrained flange adapter, "Megaflange," sizes 3 inch through 36 inch, EBAA Iron, or approved equal.

2.2 HDPE PIPE AND FITTINGS: 4 INCH THROUGH 10 INCH

- A. Pipe shall be in accordance with AASHTO M252 Type S, smooth interior and corrugated exterior.
- B. Bell and spigot joints
- C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477
- D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.3 HDPE PIPE AND FITTINGS: 12 INCH THROUGH 48 INCH

- A. Pipe shall be in accordance to AASHTO M294 Type S, smooth interior and corrugated exterior.
- B. Bell and spigot joints
- C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477
- D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint.

2.4 PVC PIPE

- A. Pipe:
 1. 4 inch through 15 inch: ASTM D3034, SDR 26 *[Check external load and laying condition, SDR 23.5 is also available if a stronger pipe is required]*
 2. 18 inch through 36 inch: ASTM F679, T-1 wall
- B. Bell and spigot joints
- C. Fittings:
 1. 4 inch through 27 inch: ASTM F1336
 2. 30 inch through 36 inch: ASTM D3034, SDR 26
- D. Joint Gasket: Elastomeric seal, ASTM F477
- E. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.5 REINFORCED CONCRETE PIPE

- A. Designated by Class, rubber gasketed joints, Type II or V cement
 1. Circular Reinforced Concrete Pipe: Oregon Standard Specifications for Construction, section 02410.
 2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Oregon Standard Specifications for Construction, section 02410.
- B. Rubber Gasketed Joints: Oregon Standard Specifications for Construction, section 02410.

PIPING MATERIALS FOR FORCE MAINS

2.6 DIP: SIZES 4 INCH THROUGH 48 INCH

- A. Pipe: Pressure Class *[insert class required based on design pressure]* pipe conforming to AWWA C151 and standard thickness per AWWA C150. U.S. Pipe, American Cast Iron Pipe Company, or approved equivalent
- B. Fittings: Provide fittings with pressure rating greater than or equal to that of the adjoining pipe.
- C. Pipe and Fitting Lining: Cement Mortar, AWWA C104. Use Type II or V cement for mortar lining.
- D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115
- E. Fittings
 1. Standard: AWWA C110, sizes 4 inch through 48 inch
 2. Compact: AWWA C153, sizes 4 inch through 24 inch
 3. All fittings shall be fusion epoxy coated per AWWA C116
- F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105. *[Use only if soil conditions warrant, i.e. corrosive soils. Check geotechnical report]*
- G. Restrained Joints:
 1. Flanged Joint: *[In general, use only in non-buried conditions, i.e. above grade or in a vault]* Provide bolts, nuts, and gaskets in conformance with AWWA C115. Gaskets shall conform to the requirements specified in AWWA C111. Unless otherwise required, above ground flange assembly bolts shall be standard hex-head, cadmium plated machine bolts with American Standard Heavy, hot -pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts shall be as above except they shall be of Type 304 stainless steel.
 2. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111 with "Field Lok Gasket," sizes 4 inch through 24 inch, "TR Flex," sizes 4 inch through 64 inch; both by U. S. Pipe, or approved equal. "Megalug" restraint harness, EBAA Iron, or approved equal.

3. Mechanical Joint: *[Pressure rating of 350 psi for sizes 3 inch through 16 inch, and 250 psi for sizes 18 inch through 48 inch]* Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111 with "Mega Lug," sizes 3 inch through 48 inch, EBAA Iron, or approved equal.
 4. Grooved and Shouldered Joints: AWWA C150, AWWA C151 and AWWA C606. 24 inch maximum size. *[Use only for above grade piping]*
- H. Insulating Joints:
1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
 2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
 3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
 4. Provide bolts and nuts as recommended in AWWA C115.
- I. Couplings: [check with manufacturer for sizes and pressure rating available]
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Smith-Blair, Inc., Dresser, or approved equal.
 2. Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Smith-Blair, Inc., Dresser, or approved equal. or 2) restrained flange adapter, "Megaflange," sizes 3 inch through 36 inch, EBAA Iron, or approved equal.

2.7 PE PIPE: SIZES 4 INCH THROUGH 65 INCH.

- A. Pipe and Fittings: AWWA C906.
- B. Joints:
 1. Thermal Butt Fusion: AWWA C906 and pipe manufacturer's recommendations
 2. Flanged Joints: AWWA C906 and pipe manufacturer's recommendations

2.8 PVC PIPE: SIZES 4 INCH THROUGH 48 INCH.

- A. Pipe: Pressure *[modify pipe class and DR per pipe design pressure and depth]* Class 200, DR 14, spigot and gasket bell end, conforming to AWWA C900 (4 inch through 12 inch and AWWA C905 (14 inch through 48 inch).
- B. Fittings: Ductile iron fittings
 1. Standard: AWWA C110, sizes 4 inch through 48 inch
 2. Compact: AWWA C153, sizes 4 inch through 24 inch
 3. All fittings shall be fusion epoxy coated per AWWA C116
- C. Unrestrained Joints: Push-On Bell and Spigot Joint: AWWA C900
- D. Restrained Joints:

1. Push-On Bell and Spigot Joint: Harness assembly as manufactured by EBAA Iron, or approved equal. *[Check with the manufacturer for sizes, pressure ratings and corrosion protection coatings that are available.]*
 2. Plain End PVC to Ductile Iron Mechanical Joint: EBAA Iron, or approved equal
- E. Steel or Ductile Iron Couplings: [check with manufacturer for sizes and pressure rating available]
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Smith-Blair, Inc., Dresser, or approved equal.
 2. Plain End Pipe to Ductile Iron or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Smith-Blair, Inc, Dresser or approved equal.
- F. PVC Couplings: [check with manufacturer for sizes and pressure rating available]
1. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by CertainTeed or approved equal.
 2. Restrained Plain End to Plain End Pipe: AWWA C900, "Fluid-Tite" as manufactured by North American Pipe, or approved equal.

2.9 GRAVITY PIPE CLEANOUTS

- A. Piping: Same as sanitary sewer line if possible
- B. Top Cap: Threaded and of same material as piping if possible
- C. Box Size: As required to provide access and allow easy removal and reinstallation of cap
- D. Box Types:
1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty
 2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading
- E. Box Cover Markings: "SANITARY SEWER" unless otherwise specified
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
1. Associated Concrete Products, Inc.
 2. Brooks Products Inc.
 3. Christy Concrete Products, Inc., or approved equal

2.10 MANHOLES

- A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans and shall conform to ASTM C478. Equivalent poured-in-place structures may be used at

the Contractor's option. Concrete shall meet Oregon Standard Specifications for Construction, section 00470. Rate for AASHTO H20 loading in traffic areas.

- B. All interior concrete surfaces shall be coated with "Xypex Crystalline" or approved equivalent. Use of a water-resistant admix is acceptable, at Contractor option.
- C. Frames and Covers: As indicated and in accordance with Oregon Standard Specifications for Construction, section 00470. Manhole covers shall have the words "SANITARY SEWER" in letters not less than 2 inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.
- D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.
- E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Plans. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.
- F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Oregon Standard Specifications for Construction section 00470 and as specified herein. The concrete shall be Class "A" containing six (6) sacks of portland cement per cubic yard of concrete. The consistency of the concrete shall be such that the slump does not exceed four inches, as determined by ASTM C143. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.
- G. Steps: ASTM C478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, or equal.

2.11 JOINT SEALANT FOR STRUCTURES AND MANHOLES

- A. Mortar: Oregon Standard Specifications for Construction, section 02410
 - 1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.
- B. Gaskets: Preformed flexible rubber or plastic gasket
 - 1. Rubber Gaskets: ASTM C443
 - 2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is "Ram-Nek," as manufactured by the Henry Company, or equal

2.12 SERVICE LATERAL RECONNECTIONS

- A. Service lateral reconnections shall be made using a PVC SDR 26 45 degree Wye; sized to fit the sewer main and the diameter of the sewer lateral.

2.13 PIPE TO STRUCTURE CONNECTOR/SEAL

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast and/or cast-in-place concrete structures.
1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
 2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.
 3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
 4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

2.14 SEWAGE AIR RELIEF VALVE ASSEMBLY FOR FORCE MAINS

- A. Air release and vacuum valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin, DeZurik/APCO or approved equal.

2.15 THRUST BLOCKS FOR FORCE MAINS

- A. General: Location and configuration as indicated
- B. Portland Cement Concrete: Section 32 13 18, Cement and Concrete for Exterior Improvements

2.16 GATE VALVES

- A. Gate Valves shall be iron, 125 class, rated working pressure of 125 psi steam (minimum) and 200 psi WOG, wheel handle, non-rising bronze or stainless steel stem, and conform to MSS SP-80. Stuffing box shall be repackable under pressure. Packing shall be injection type approved. Manufactured by Crane, Nibco, Powell, Milwaukee, Kennedy, Grinnell, Walworth, Fairbanks, Jenkins, Lunkenheimer, Stockham, Hammond, or approved. Similar to Nibco F-619.

2.17 GATE VALVES

- A. Gate Valves shall be iron, 125 class, rated working pressure of 125 psi steam (minimum) and 200 psi WOG, wheel handle, non-rising bronze or stainless steel stem, and conform to MSS SP-80. Stuffing box shall be repackable under pressure. Packing shall be injection type approved. Manufactured by Crane, Nibco, Powell, Milwaukee, Kennedy, Grinnell, Walworth, Fairbanks, Jenkins, Lunkenheimer, Stockham, Hammond, or approved. Similar to Nibco F-619.

2.18 CHECK VALVE

- A. Check valve shall be swing, renewable seat and disc, iron, 125 class, rated working pressure of 125 psi steam and 200 psi WOG, flanged ends, bronze trim and disc, bolted bonnet. Manufactured by Crane, Nibco, Powell, Milwaukee, Kennedy, Grinnell, Walworth, Fairbanks, Jenkins, Lunkenheimer, Stockham, Hammond, or approved. Similar to Hammond IR 1124.

2.19 TRENCH DRAIN

- A. Shall be precast polymer concrete pre-sloped channel sections with interlocking joints and horizontal ribs to ensure a positive anchor in the encasement concrete. Provide with end caps as necessary and properly fitting outlets. Provide end or bottom outlet as indicated on Drawings.
- B. Polycast: Provide Polycast Sections 601 and larger, iron frame, and slotted grate assembly, load class E.
- C. Polydrain: Provide Polydrain Sections 010 and larger, iron frame, and slotted grate assembly, load class E.
- D. Other manufacturers will be considered with approved submittal.

2.20 CONCRETE

- A. Concrete shall be ready-mixed conforming to Section 03 30 00, CAST-IN-PLACE CONCRETE, and shall have a compressive strength of 3,000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

PART 3 - EXECUTION**3.1 EXISTING CONDITIONS**

- A. Prior to starting work of this section, carefully inspect trench, excavations, and pipe bedding to verify that all such work is complete to the point where this installation may properly commence.
- B. Do not install work of this section until unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

- C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.2 GRAVITY PIPE INSTALLATION

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance OSSC, section 02415, for plastic pipe, OSSC, section 02410, for reinforced concrete pipe and OSSC, section 02420 for ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.3 LIFT STATION

- A. Construct in accordance with drawings and per manufacturer's recommendations.
- B. Coordinate power and control conduit extension into building with Building Electrical Contractor.

- C. All electrical system installation and wiring must be performed by a qualified electrician and according to the National Electrical Code.

3.4 FORCE MAIN PIPE INSTALLATION

- A. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) shown on the Plans.
- B. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- C. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- D. Pipe laying and jointing:
 - 1. Provide proper facilities for lowering sections of pipe into trenches.
 - 2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
 - 3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 - 4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
 - 5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
 - 6. Support pipe at proper elevation and grade.
 - 7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
 - 8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 - 9. Provide anchors and supports where indicated and where necessary for fastening work into place.
 - 10. Make proper provision for expansion and contraction of pipelines.
 - 11. Keep trenches free of water until joints have been properly made.
 - 12. Do not lay pipe when conditions of trench or weather prevent proper installation.
 - 13. All fittings shall be blocked with appropriately sized thrust blocks as shown on the Plans.
 - 14. Installation of Tracer Wire:
 - 15. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 - 16. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
 - 17. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.

18. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.
- E. Installation of Warning Tape
 1. Install tape approximately 1 foot above and along the centerline of the pipe.
 2. Where tape is not continuous, lap tape ends a minimum of 2 feet.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Connections to Existing Lines:
 1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
 2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.
- H. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.5 INSTALLATION OF DUCTILE-IRON PIPING

- A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.
- B. Jointing:
 1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
 2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
 3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.
 - a. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
 - b. Align bolt holes for each flanged joint.
 - c. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
 - d. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.

- e. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
 - f. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the setscrewed flange manufacturer.
4. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.
 5. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.
- C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 8-mil linear low-density polyethylene (LLD) film or 4-mil high-density cross-laminated (HDCL) film per manufacturer's recommendations and in accordance with AWWA C105 and ASTM A674.
- D. Pipe Anchorage: Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.6 INSTALLATION OF POLYVINYL CHLORIDE PIPING

- A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA M23.
- B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.
- C. Jointing:
 1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
 2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
 3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
 5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
 6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
 7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

- D. Pipe Anchorage:
1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.7 INSTALLATION OF POLYETHYLENE PIPING

- A. Install pipe, fittings, and appurtenances in accordance with manufacturer's recommendations.
- B. Jointing:
1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
 2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
 3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.
 4. Butt fusion:
 - a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
 - b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
 - c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
 - d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
 - e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the manufacturer's recommendations for temperature, pressure, holding, and cooling times.
 - f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.
 5. Socket fusion:
 - a. Mixing manufacturers' heating tools and depth gages will not be allowed unless the tools conform to ASTM F1056.
 - b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
 - c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
 - d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.

- e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
 - f. Simultaneously remove the pipe and fitting from the tool.
 - g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
 - h. Hold or block the pipe in place during cooling.
6. Electrofusion:
- a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
 - b. Clamp the pipe and fitting at the proper position in the fixture.
 - c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
 - d. Allow the joint to cool before removing the clamping fixtures.

3.8 CLEANOUTS

- A. Construct on compacted 4" minimum depth 3/4" - 0 crushed rock base level, plumb, and square with adjacent surfaces. Set rim flush with adjacent finished surfaces unless otherwise noted.

3.9 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Manufacturers' instructions

3.10 POURED-IN-PLACE CONCRETE

- A. Concrete shall be mixed in accordance with applicable provisions of section 00540 of the OSSC.
- B. Construction of concrete structures shall conform to applicable provisions of section 00540 of the OSSC. Unless otherwise noted herein or in the Plans, exposed surfaces of structures shall be Class 1 surface finish.
- C. Curing shall conform to applicable portions in Section 90 of section 00540 of the OSSC. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.
- D. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.11 GRAVITY PIPELINE AIR TESTING AND FLUSHING

- A. All new sections of sanitary sewer shall be tested using the following procedures:
1. Test is conducted between two consecutive manholes, or as directed by the Project Manager.
 2. The test section of the sewer shall be plugged at each end. One of the plugs used at the manhole shall be tapped and equipped for the air inlet connection for filling the line from an air compressor.
 3. All service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged and carefully braced against the internal pressure to prevent air leakage by slippage and blowout.
 4. Connect air hose to tapped plug selected for the air inlet. Connect the other end of the air hose to the portable air control equipment, which consists of valves and pressure gauges used to control the air entry rate into the sewer test section, and to monitor the air pressure in the pipeline. More specifically, the air control equipment includes a shut-off valve, pressure regulating valve, pressure reduction valve, and a monitoring pressure gauge having a pressure range from 0-5 psi. The gauge shall have minimum divisions of 0.10 psi and an accuracy of 0.40 psi.
 5. Connect another air hose between the air compressor (or other source of compressed air) and the air control equipment. This completes the test equipment set-up. Test operations may commence.
 6. Supply air to the test section slowly, filling the pipeline until a constant pressure of 3.5 psig is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 5.0 psig.
 7. When constant pressure of 3.5 psig is reached, throttle the air supply to maintain the internal pressure above 3.0 psig for at least 5 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall. During this stabilization period, it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections. If leakage is detected at any cap plug, release the pressure in the line and tighten all leaky caps and plugs. Start the test operation again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, a new 5-minute interval must be allowed after the pipeline has been refilled.
 8. After the stabilization period, adjust the air pressure to 3.5 psig and shut-off or disconnect the air supply. Observe the gauge until the air pressure reached 3.0 psig. At 3.0 psig, commence timing with a stopwatch until the pressure drops to 2.5 psig, at which time the stop watch is stopped. The time required, as shown on the stopwatch, for a pressure loss of 0.5 psig is used to compute the air loss.
 9. If the time, in minutes and seconds, for the air pressure drop from 3.0 to 2.5 psi is greater than that shown in the following table for the designated pipe size, the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued at any time.
 10. If the time, in minutes and seconds, for the 0.5 psig drop is less than that shown in the following table for the designated pipe size, the section of the pipe shall

not have passed the test; therefore, adequate repairs must be made and the line retested.

Requirements for Air Testing

Pipe Size (in inches)	Time	
	Minutes	Seconds
4	2	32
6	3	50
8	5	6
10	6	22
12	7	39
14	8	56
15	9	35
16	10	12
18	11	34
20	12	30

11. For 8 inch and smaller pipe, only: if, during the 5 minute saturation period, pressure drops less than 0.5 psig after the initial pressurization and air is not added, the pipe section undergoing test shall have passed.
12. Multi-pipe sizes: when the sewer line undergoing test is 8 inch or larger diameter pipe and includes 4 inch or 6 inch laterals, the figures in the table for uniform sewer main sizes will not give reliable or accurate criteria for the test. Where multi-pipe sizes are to undergo the air test, the Project Manager can compute the "average" size in inches which is then multiplied by 38.2 seconds. The results will give the minimum time in seconds acceptable for a pressure drop of 0.5 psig for the "averaged" diameter pipe.
13. Adjustment Required for Groundwater:
 - a. An air pressure correction is required when the ground water table is above the sewer line being tested. Under this condition, the air test pressure must be increased .433 psi for each foot the ground water level is above the invert of the pipe.
 - b. Where ground water is encountered or is anticipated to be above the sewer pipe before the air testing will be conducted, the following procedure shall be implemented at the time the sewer main and manholes are constructed.
 - 1) Install a ½ inch diameter pipe nipple (threaded one or both ends, approximately 10 inch long) through the manhole wall directly on top of one of the sewer pipes entering the manhole with threaded end of nipple extending inside the manhole.
 - 2) Seal pipe nipple with a threaded ½ inch cap.
 - 3) Immediately before air testing, determine the ground water level by removing the threaded cap from the nipple, blowing air through the pipe nipple to remove any obstruction, and then connecting a clear plastic tube to the pipe nipple.
 - 4) Hold plastic tube vertically permitting water to rise in it to the groundwater level.

- 5) After water level has stabilized in plastic tube, measure vertical height of water, in feet, above invert of sewer pipe.
 - 6) Determine air pressure correction, which must be added to the 3.0 psig normal starting pressure of test, by dividing the vertical height in feet by 2.31. The result gives the air pressure correction in pounds per square inch to be added.
- B. After the line has passed the air test, it shall be balled and flushed with water to clean. A metal screen shall be used downstream at the point of connection to the existing system to collect and remove any rock or other debris that is flushed out during cleaning.

3.12 TESTING OF MANHOLES ON GRAVITY LINES

- A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.
1. Hydrostatic Test: In general, the following hydrostatic test is in conformance with that presented in Clean Water Services Standard Specifications.
 2. Insert inflatable plugs in all sewer inlets and outlets.
 3. Fill the manhole with water to a point six inches below the base of the manhole frame.
 4. Maintain the water at this point for one hour to allow time for absorption.
 5. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
 6. Determine the allowable leakage by the following formula.

$$L = 0.0002 \times D \times H^{1/2}$$

L = Allowable leakage, gallons per minute.
 D = Depth of manhole from top to bottom, feet.
 H = Head of water in feet as measured from the surface of the water in the manhole to the sewer line invert or to the prevailing ground water surface outside the manhole. The lesser height governs.
 7. If the leakage exceeds the allowable, determine the cause, take remedial action and re-test the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.
- B. Vacuum Test:
1. General: Test in accordance with ASTM C1244.
 2. Test prior to backfilling around the manhole.
 3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
 4. Place test head inside the top section of the manhole's cone section and inflate in accordance with the manufacturer's instructions.
 5. Draw a vacuum of 10 inches of mercury and shut the pump off.
 6. With the valve closed, the time for the vacuum to drop 9 inches shall be measured.

7. The manhole shall pass the test if the time is greater than 60 seconds for a 48 inch diameter manhole, 75 seconds for a 60 inch diameter manhole and 90 seconds for a 72 inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout. Once the repair material has cured according to the manufacturer's recommendations the vacuum test shall be repeated. This process shall continue until a satisfactory test is obtained.
9. All temporary plugs and braces shall be removed after each test.

3.13 HYDROSTATIC AND LEAKAGE TESTING OF FORCE MAINS

A. General:

1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Apply test pressure by means of a pump connected to the pipe.
7. Base test pressure on the elevation of the lowest point in the line.
8. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
9. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
10. The pressure test on mortar-lined pipe shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption in the cement mortar lining.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.
16. Preparation for Test
17. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
18. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
19. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.

20. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.
 21. A joint previously tested in accordance with this specification may be covered or insulated.
 22. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
 23. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.
- B. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
 3. No piping will be accepted if the leakage is greater than that determined by the following formula:
- $$L = (S \times D \times P^{1/2})/133,200$$
- L = Allowable leakage, gallons per hour.
 S = Length of pipe tested, feet.
 D = Nominal diameter of pipe, inches.
 P = Average test pressure during the leakage test, pounds per square inch (gauge).
- C. PE Pipe Leakage Test:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
 3. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for four hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.

Nominal Pipe Size (in.) Test	Allowance for Expansion (U.S. Gals./100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

- D. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
 3. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P^{1/2}) / 7,400$$

L = Allowable leakage, gallons per hour.

N = Number of joints in the length of the pipeline tested.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

3.14 DEFLECTION TESTING

- A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.

- B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.
- C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.
- D. Pull-Through Device:
1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
 - a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
 - b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
 2. Ball, cylinder, or circular sections shall conform to the following:
 - a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
 - b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
 - c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
 - d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
- E. Pull-Through Device:
1. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
 2. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
- F. Deflection measuring Device:
1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
 2. Obtain approval of deflection measuring device prior to use.
- G. Deflection Measuring Device Procedure:
1. Measure deflections through each run of installed pipe.
 2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
 3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace

with new pipe, and completely retest in same manner and under same conditions.

- H. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.15 CLEANING

- A. Thoroughly clean sewer lines and manholes of sediments, dirt, debris, and obstructions of any kind.

3.16 TELEVISION INSPECTION

- A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the sewer line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the Owner for review.
- B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
 - 1. Low spot (1 inch or greater - mainlines only)
 - 2. Joint separations (3/4 inch or greater opening between pipe sections)
 - 3. Cocked joints present in straight runs or on the wrong side of pipe curves
 - 4. Chips in pipe ends
 - 5. Cracked or damaged pipe
 - 6. Dropped joints
 - 7. Infiltration
 - 8. Debris or other foreign objects
 - 9. Other obvious deficiencies
 - 10. Irregular condition without logical explanation

END OF SECTION

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SECTION 33 41 00**STORM UTILITY DRAINAGE PIPING****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Site storm drainage system up to five feet of any on-site building

1.2 RELATED SECTIONS

- A. Section 31 21 00, Utility Trenching and Backfill
- B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. AASHTO
 - 1. M199: Precast Reinforced Concrete Manhole Sections
 - 2. M252: Corrugated Polyethylene Drainage Pipe
 - 3. M294: Corrugated Polyethylene Pipe, 12 to 604 inch Diameter
- B. ASTM
 - 1. A74: Cast Iron Soil Pipe and Fittings
 - 2. A615: Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
 - 4. C443: Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - 5. C478: Circular Precast Reinforced Concrete Manhole Sections
 - 6. C564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - 7. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 - 8. C1173: Flexible Transition Couplings for Underground Piping Systems
 - 9. D1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 10. D2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
 - 11. D2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
 - 12. D3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 13. D4101: Propylene Injection and Extrusion Materials
 - 14. F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 15. F656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 - 16. F679: Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
 - 17. F1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings
- C. AWWA
 - 1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
 3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water
 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 5. C115: Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
 6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
 7. C150: Thickness design of Ductile Iron Pipe
 8. C151: Ductile-Iron Pipe, Centrifugally Cast
 9. C153: Ductile-Iron Compact Fittings
 10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
 11. M41: Ductile Iron Pipe and Fittings
- D. Oregon Standard Specifications for Construction, current edition.
1. Section 00445, Sanitary, Storm, Culvert, Siphon, and Irrigation Pipe
 2. Section 00470, Manholes, Catch Basins, and Inlets

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing Materials
- C. AWWA: American Water Works Association
- D. OSSC: Oregon Standard Specifications for Construction
- E. CMP: Corrugated metal pipe
- F. DIP: Ductile iron pipe
- G. HDPE: High-density polyethylene
- H. NPS: Nominal pipe size
- I. PE: Polyethylene
- J. PVC: Polyvinyl Chloride
- K. RCP: Reinforced concrete pipe

1.5 SUBMITTALS [EDIT SUBMITTAL LIST PER MATERIAL ON THE JOB]

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Product data for the following:
1. Piping materials and fittings
 2. Special pipe couplings

3. Polymer-concrete, channel drainage systems (trench drains)
 4. Joint sealants
 5. Plastic area drains
 6. Cleanout plugs or caps
 7. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates
 8. Precast clean out boxes and box covers
 9. Concrete, metal and plastic flared end sections
- C. Shop drawings: Include plans, elevations, details and attachments for the following:
1. Precast concrete manholes, frames and covers
- D. Design Mix Reports and Calculations: For each class of cast in place concrete
- E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage
1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling
1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
 2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.
 3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 CAST IRON PIPE AND FITTINGS: 2 INCH THROUGH 15 INCH

- A. Hub and spigot, ASTM A74, service class
- B. Gaskets: ASTM C564, rubber, compression type, thickness to match class of pipe
- C. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined

2.2 CORRUGATED METAL PIPE AND FITTINGS:

- A. CMP pipe shall be in accordance to Oregon Standard Specifications for Construction section 02420
- B. Bituminous Coating: OSSC section 02420.20
- C. Bituminous Lining: OSSC section 02420
- D. Bituminous Paving: OSSC section 02420
- E. Corrugated Aluminum Pipe: OSSC section 02420.40
- F. Corrugated Steel Pipe: OSSC section 02420.10
- G. Slotted Corrugated Steel Pipe: OSSC section 02420

2.3 DIP: SIZES 4 INCH THROUGH 48 INCH

- A. Pipe conforming to AWWA C151 and C150
- B. Pipe: Pressure Class Pressure Class: Minimum pressure class for size indicated *[Check loading and determine wall thickness if pipe is deep or shallow with AASHTO H20 loading]*
- C. Pipe and Fitting Lining: Cement Mortar, AWWA C104
- D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115
- E. Fittings
 - 1. Standard: AWWA C110, sizes 4 inch through 48 inch
 - 2. Compact: AWWA C153, sizes 4 inch through 24 inch
 - 3. All fittings shall be fusion epoxy coated per AWWA C116
- F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105
- G. Unrestrained Joints (Rubber Gasket Joints):
 - 1. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111.
 - 2. Mechanical Joint: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.
- H. Insulating Flanged Joints:
 - 1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
 - 2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.

3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
 4. Provide bolts and nuts as recommended in AWWA C115.
- I. Couplings: [check with manufacturer for sizes available]
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Smith-Blair, Inc., Dresser, or approved equal.
 2. Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Smith-Blair, Inc., Dresser, or approved equal.

2.4 PE PIPE AND FITTINGS (HDPE): 4 INCH THROUGH 10 INCH

- A. Pipe shall be in accordance with AASHTO M252 Type S, smooth interior and corrugated exterior
- B. Bell and spigot joints
- C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477
- D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.5 PE PIPE AND FITTINGS (HDPE): 12 INCH THROUGH 48 INCH

- A. Pipe shall be in accordance to AASHTO M294. Type S, smooth interior and corrugated exterior.
- B. Bell and spigot joints
- C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477
- D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.6 PVC PIPE AND FITTINGS-SMALLER THAN 4 INCH

- A. Pipe shall be in accordance to ASTM D1785, Schedule 40. *[Check external load and laying condition, schedule 80 and 120 are also available if stronger pipe is required.]*
- B. Joints: Solvent Cement, ASTM D2564
- C. Include primer according to ASTM F656
- D. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.7 PVC PIPE, 4 INCH AND LARGER

- A. Pipe
 - 1. 4 inch through 15 inch: ASTM D3034, SDR 35
 - 2. 18 inch through 36 inch: ASTM F679, T-1 wall
- B. Bell and spigot joints
- C. Fittings:
 - 1. 4 inch through 27 inch: ASTM F1336
 - 2. 30 inch through 36 inch: ASTM D3034, SDR 35
- D. Joint Gasket: Elastomeric seal, ASTM F477
- E. Special Pipe Coupling: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined

2.8 REINFORCED CONCRETE PIPE

- A. Designated by Class, rubber gasketed joints, Type II or V cement
 - 1. Circular Reinforced Concrete Pipe: Oregon Standard Specifications for Construction, section 02410.10.
 - 2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Oregon Standard Specifications for Construction, section 02410.10.
- B. Rubber Gasketed Joints: OSSC section 02440.40
- C. Special Pipe Couplings: Portland cement collar as indicated

2.9 PIPE ANCHORS

- A. General: Location, configuration bearing area, etc. as indicated
- B. Portland Cement Concrete: Section 32 13 18, Cement and Concrete for Exterior Improvements

2.10 PIPE CLEANOUTS

- A. Piping: Same as storm drain line if possible
- B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.
- C. Box Size: As required to provide access and allow easy removal and reinstallation of cap
- D. Box Types
 - 1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty

2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading
- E. Box Cover Markings: "S.D.," unless otherwise specified
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
1. Associated Concrete Products, Inc.
 2. Brooks Products Inc.
 3. OldCastle Precast/Christy Concrete Products, Inc.

2.11 AREA DRAINS

- A. Grate and Riser: Area drain shall be as manufactured by Nyloplast or approved equal. Riser shall be constructed of 6 inch PVC SDR 35 piping per paragraph 2.1(A) of this section and connected to area drain by a gasket joint. Riser shall be vertical except as otherwise noted in the plans. Riser may include a reducer if necessary to make connection to the storm drain line.
- B. Elevation and Grading: Area Drain rim elevation shall be set and area around area drain shall be graded to drain away from any adjacent structures, walks, or roadways and towards area drain.

2.12 CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

- A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.
- B. Portland Cement Concrete and Reinforcing: Section 32 13 18, Cement and Concrete for Exterior Improvements.
- C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.
- D. Steps: ASTM C 478 or AASHTO M199. Manufacture from deformed, 1/2 inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step.
- E. Frames, Grates and Covers: Oregon Standard Specifications for Construction, section 02450.30
1. Galvanize steel frames, grates and covers
 2. Grates and covers shall be non-rocking
 3. Rate for AASHTO H20 loading in traffic areas

2.13 SINGLE CHAMBER CATCH BASINS

- A. Shall be prefabricated steel, 24 inches square by 36 (minimum) inches deep, 10 gauge minimum, asphalt paint inside and out, 6 inch minimum water seal with hinged lid on trap, outlet size as specified on drawings. Cast iron or steel grate with bicycle bars. Lynch or Gibson.
- B. Use any of the following pipe materials from the catch basin to lateral where cover is less than one foot as detailed on drawings: Ductile Iron pipe and fittings (cement-lined), Class 52, AWWA C151; PVC, AWWA C900, CL150; Schedule 40 PVC, ASTM D2665, F891, or D1785 (latest revision).

2.14 DOUBLE CHAMBER SEPARATOR CATCH BASINS

- A. Shall be prefabricated steel, each chamber to be 24 inches square by 36 (minimum) inches deep with a 24-inch sump, 10 gauge minimum, asphalt paint inside and out, 6 inch minimum water seal with hinged lid on trap, outlet size (3" - 6") as specified on drawings. Outlet location shall be in accordance with catch basin orientation as shown on plan. Grated cover to be cast iron or steel grate with bicycle bars, unless specified as ADA grates on the drawings. Solid cover to be diamond plate. Both covers to be H20 traffic rated.
- B. Use any of the following pipe materials from the catch basin to lateral where cover is less than one foot as detailed on drawings: Ductile Iron pipe and fittings (cement-lined), Class 52, AWWA C151; PVC, AWWA C900, CL150; Schedule 40 PVC, ASTM D2665 or F891 (latest revision).
- C. ADA compliant grates to be H20 traffic rated, with 1/2" maximum clear space parallel to the predominant direction of pedestrian travel.

2.15 MANHOLES

- A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans and shall conform to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor's option.. Rate for AASHTO H20 loading in traffic areas.
- B. All interior concrete surfaces shall be coated with "Xypex Crystalline" or approved equivalent. Use of a water-resistant admix is acceptable, at Contractor option.
- C. Frames and Covers: As indicated and in accordance with Oregon Standard Specifications for Construction, section 02450.30. Manhole covers shall have the words "STORM DRAIN" in letters not less than 2 inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.
- D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.
- E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Plans.

Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.

- F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Oregon Standard Specifications for Construction section 00440 and as herein specified. The concrete shall be Class "A" containing six (6) sacks of portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the CDT requirements of the three-quarter inch maximum. The consistency of the fresh aggregate shall be such that the slump does not exceed four inches, as determined by ASTM C143. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.
- G. Steps: ASTM C478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, or approved equal.

2.16 JOINT SEALANT FOR PRECAST STRUCTURES AND MANHOLES

- A. Mortar: Oregon Standard Specifications for Construction section 02440
 - 1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.
- B. Gaskets: Preformed flexible rubber or plastic gasket
 - 1. Rubber Gaskets: ASTM C443
 - 2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is "Ram-Nek," as manufactured by Henry Company, or approved equal.

2.17 PIPE TO STRUCTURE CONNECTOR/SEAL

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast and/or cast-in-place concrete structures.
 - 1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
 - 2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.

3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

2.18 POLYMER-CONCRETE TRENCH DRAINS

- A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.
- B. Include the following components:
 1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
 2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.
- C. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. "Polydrain" by ABT Inc.
 2. "ACO Drain" by ACO Polymer Products Inc. , or approved equal

2.19 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS

- A. General: Oregon Standard Specifications for Construction section 02450.

2.20 SLOPE PROTECTION

- A. Rock Slope Protection: Oregon Standard Specifications for Construction section 00398.
 1. Fabric: Oregon Standard Specifications for Construction section 00398.
 2. Concrete/Shotcrete Slope Protection: Oregon Standard Specifications for Construction section 00396.
 3. Bar Reinforcement: Oregon Standard Specifications for Construction section 00396.
 4. Welded Wire Fabric: Oregon Standard Specifications for Construction section 00398.14.
- B. Concreted-Rock Slope Protection: Oregon Standard Specifications for Construction section 00398.
- C. Sacked Concrete Slope Protection
 1. Concrete: Section 32 13 18 Cement and Concrete for Exterior Improvements

2. Sacks: 10 ounce burlap measuring approximately 19.5 inches by 36 inches when empty and laid flat

2.21 CONCRETE DITCH LINING

- A. General: Oregon Standard Specifications for Construction section 00749
 1. Bar Reinforcement: Oregon Standard Specifications for Construction section 00749.
 2. Welded Wire Fabric: Oregon Standard Specifications for Construction section 00396.43.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. General: I Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance OSSC, section 02415, for plastic pipe, OSSC, section 02410, for reinforced concrete pipe and OSSC, section 02420 for ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.2 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Manufacturers' instructions

3.3 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC. AND MANHOLES

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- B. Poured in Place Structures: Install as indicated and Oregon Standard Specifications for Construction section 00470.43
 - 1. Shape bottoms to convey flows as indicated.
- C. Precast Structures: Install as indicated.
 - 1. Seal all joints and pipe entrances and exits.
 - 2. Place concrete in bottom and shape to convey flows as indicated.

3.4 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- B. Install: As indicated and in accordance with the manufacturer's instructions.

3.5 SLOPE PROTECTION PLACEMENT

- A. Rock Slope Protection: Oregon Standard Specifications for Construction section 00398
- B. Concrete/Shotcrete Slope Protection: Oregon Standard Specifications for Construction section 00396
- C. Concreted-Rock Slope Protection: Oregon Standard Specifications for Construction section 00398
- D. Sacked Concrete Slope Protection
 - 1. Detailed configuration: As indicated
 - 2. Use one cubic foot of concrete per sack.
 - 3. Locate headers and stretchers as indicated.
 - 4. Headers: Folded end to bank
 - 5. Stretchers: Folded ends are not to be adjacent.
 - 6. Place no more than four vertical courses until initial set has taken place in first course.

3.6 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT

- A. Concrete/Shotcrete Slope Protection: Oregon Standard Specifications for Construction section 00749

3.7 POURED-IN-PLACE CONCRETE

- A. Concrete shall be mixed in accordance with applicable provisions of the Oregon Standard Specifications for Construction section 00470.43
- B. Construction of concrete structures shall conform to applicable provisions of Oregon Standard Specifications for Construction section 00759.
- C. Curing shall conform to applicable portions in the Oregon Standard Specifications for Construction section 00759. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.
- D. Concrete shall not be cropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.8 PIPELINE FLUSHING

- A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.

3.9 DEFLECTION TESTING

- A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.
- B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.
- C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.
- D. Pull-Through Device:
 - 1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
 - a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.

- b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
 2. Ball, cylinder, or circular sections shall conform to the following:
 - a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
 - b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
 - c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
 - d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
 3. Pull-Through Device:
 - a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
 - b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
- E. Deflection measuring Device:
 1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
 2. Obtain approval of deflection measuring device prior to use.
- F. Deflection Measuring Device Procedure:
 1. Measure deflections through each run of installed pipe.
 2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
 3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.
- G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.10 CLEANING

- A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

3.11 TELEVISION INSPECTION

- A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the drain line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the Owner for review.
- B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
1. Low spot (1 inch or greater - mainlines only)
 2. Joint separations (3/4 inch or greater opening between pipe sections)
 3. Cocked joints present in straight runs or on the wrong side of pipe curves.
 4. Chips in pipe ends
 5. Cracked or damaged pipe
 6. Dropped joints
 7. Infiltration
 8. Debris or other foreign objects
 9. Other obvious deficiencies
 10. Irregular condition without logical explanation

END OF SECTION

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SECTION 33 46 00**SUBDRAINAGE****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Subdrains in trenches and subdrains or prefabricated composite drainage panels at walls or foundations
- B. Subdrains in bioretention and biofiltration areas for storm water treatment

1.2 RELATED SECTIONS

- A. Section 31 23 33, Utility Trenching and Backfill
- B. Section 33 41 00, Storm Utility Drainage Piping

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Report of Geotechnical Engineering Services – Elmonica, by NV5, January 12, 2022.
- B. AASHTO
 - 1. M288: Standard Specification for Geotextiles Used for Subsurface Drainage Purposes
- C. ASTM
 - 1. C1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems
 - 2. D448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - 3. D1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics
 - 4. D1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 5. D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 - 6. D2564: Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
 - 7. D2729: Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 8. D3034: Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 9. D4716: Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head

10. F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 11. F656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 12. F1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings
- D. Oregon Standard Specifications for Construction, current edition.
1. OSSC Section 00430, Subsurface Drains

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing and Materials
- C. PVC: Polyvinyl Chloride
- D. OSSC: Oregon Standard Specifications for Construction, current edition.

1.5 SUBMITTALS

- A. Follow submittal procedure in accordance with Section 01 10 00, Supplemental General Requirements.
- B. Product data for the following:
1. Perforated pipe and fittings
 2. Solid pipe and fittings
 3. Prefabricated composite drainage panels
 4. Geotextile fabrics
 5. Cleanout plugs or caps
 6. Precast clean out boxes and box covers
 7. Drainage bubblers
 8. Biofiltration soil material
- C. Samples:
1. Drainage Fill

1.6 DELIVERY, STORAGE AND HANDLING

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe-fittings, and seals from dirt and damage.
- C. Protect permeable material from contamination by other materials.

PART 2 - PRODUCTS**2.1 PERFORATED WALL AND SOLID WALL PIPE**

- A. PVC pipe and Fittings Smaller than 4-inch:
 - 1. Pipe: ASTM D1785, Schedule 40. Solvent cement joints
 - 2. Solvent Cement: ASTM D2564. Include primer according to ASTM F656.
 - 3. Perforation Size, Location, and Spacing: ASTM D2729

- B. PVC Pipe and Fittings 4-inch through 15-inch:
 - 1. Pipe: ASTMD3034, SDR 26. Bell and spigot joints
 - 2. Perforation Size, Location, and Spacing: ASTM D2729
 - 3. Fittings: ASTM F1336
 - 4. Joint Gasket: Elastomeric seal, ASTM F477

2.2 SPECIAL PIPE COUPLINGS

- A. Description: ASTM C1173. Rubber or elastomeric sleeve and stainless steel band assembly fabricated to match outside diameters of pipes to be joined.

2.3 CLEANOUTS

- A. Piping: Same as subdrain pipe without perforations.

- B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.
 - 1. Size box to provide access and allow easy removal and reinstallation of plug or cap.
 - 2. Types:
 - a. Non-Traffic Areas: Portland cement concrete box and box cover, light duty.
 - b. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading.

- C. Cover Markings: "STORM DRAIN" unless otherwise specified.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - a. Associated Concrete Products, Inc.,
 - b. Brooks Products Inc.,
 - c. Christy Concrete Products, Inc., or approved equal

2.4 PREFABRICATED COMPOSITE DRAINAGE PANELS

- A. Description: Prefabricated composite panels, 36 to 60 inches wide and manufactured with geotextile facing laminated to molded drainage core

- B. Drainage Core: Three-dimensional, non-biodegradable, molded Polypropylene or Polystyrene
 - 1. Minimum Compressive Strength: 10,000-lbf./sq. ft. when tested according to ASTM D1621
 - 2. Minimum Flow Rate: 2.8 gpm per foot at hydraulic gradient of 0.05 and compressive stress of 25 psig when tested according to ASTM D4716
- C. Geotextile: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M288
 - 1. Survivability Class: 1
 - 2. Apparent Opening Size: No. 70 sieve maximum
 - 3. Permittivity: 0.5 per second, minimum
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. American Wick Drain Corporation
 - 2. Tencate Geosynthetics/Mirafi Inc.
 - 3. Multi-Flow (Prinsburg, MN) (Tel. 800-978-8007)
 - 4. Phillips Fibers Corporation, or approved equal

2.5 BIORETENTION OR BIOFILTRATION TREATMENT SOIL

- A. Soil specification shall meet requirements of local agency having authority or sustainability requirements for projects achieving environmental goals.

2.6 DRAINAGE FILL MATERIAL

- A. Granular Drain Backfill Material shall adhere to the Oregon Standard Specifications for Construction section 00430
- B. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Sieve No. 57, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 8 sieve

2.7 GEOSYNTHETICS

- A. When required, use filter fabric for encasing permeable material around subdrains.
 - 1. Filter Fabric: Oregon Standard Specifications for Construction section 00350
 - 2. Mirafi 140N (by Tencate Geosynthetics/Mirafi Inc.), or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

- B. Install only after unsatisfactory conditions have been corrected.

3.2 PIPING APPLICATIONS

- A. Refer to Plans for location, size, and material designation for individual subdrains.

3.3 INSTALLATION OF PERFORATED PORTIONS OF SUBDRAINS

- A. Excavation: Section 6 of ASTM D2321 and as indicated.
- B. Subdrain Bedding: Place supporting layer of drainage fill over compacted subgrade to compacted depth indicated. If drainage fill requires encasement in filter fabric, lay filter fabric in trench and overlap trench sides before installing drainage fill.
- C. Piping Installation: Install pipe in accordance with Section 7 of ASTM D2321. Install piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Excavate recesses for bottoms of bell ends of pipe. Lay pipe with bells facing upslope and with spigot end centered fully into adjacent bell. Bed piping with full pipe bearing in drainage fill material. Lay perforated pipe with perforations down. Install gaskets, seals, sleeves, and couplings in accordance with manufacturers written instructions. Use increasers, reducers, and couplings made for different sizes of materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- D. Initial Subdrain Backfill: After installing drainage piping, add drainage fill up to top of pipe to perform tests.
- E. Testing Subdrain: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling with drainage fill. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- F. Subsequent Subdrain Backfill: After satisfactory testing, cover piping with drainage fill to width and height indicated. Place drainage fill in layers not exceeding 3 inches in loose depth; compact each layer placed. If filter fabric is required complete the filter fabric encasement by bringing fabric to top and closing the encasement.
- G. Fill to Grade: Place native fill material over compacted drainage fill to thickness indicated. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish elevations.

3.4 INSTALLATION OF NON-PERFORATED PORTIONS OF SUBDRAINS

- A. Conform to Sections 31 23 33, Utility Trenching and Backfill and 33 41 00, Storm Utility Drainage Pipe.

3.5 INSTALLATION OF RAIN GARDENS, BIORETENTION OR BIOFILTRATION TREATMENT AREAS

- A. The Contractor shall excavate rain gardens / treatment areas to the elevations and dimensions specified on the plans. Level surface of area of top of treatment soil shown on the plans shall govern actual length and width dimensions if shown on the plans. In-situ soils shall not be further compacted.
- B. Direct the use of heavy equipment and construction traffic around rain gardens so as to avoid compaction, to the extent possible.
- C. After initial site grading, the Contractor shall provide temporary protection from curb cuts and other potential inflow entrances so that runoff drainage does not enter the rain gardens during construction and installation.
 - 1. Treatment areas / rain gardens may be used as sediment settling facilities during mass excavation and commensurate construction activities.
 - 2. Prior to commencing work in rain gardens, the Contractor shall remove and properly dispose of all accumulated sediments.
- D. Excavated soils shall be placed with stockpiled fill and properly disposed and stabilized by the Contractor.
- E. Subdrain installation:
 - 1. Subdrain shall be installed as indicated on the plans at an elevation within the drain rock layer shown on the construction details and connected to the overflow or outfall structure at the invert elevation shown on the plans.
 - 2. For connections of the perforated drain pipes to storm drainage structures, appropriately sized holes shall be cut in the structures at the correct invert elevation specified by the Project Designer or authorized representative. The connections shall be sealed sediment-tight and secured in place with mortar or other approved joint sealant compatible with subdrain pipe materials.
 - 3. Drain rock layer shall be approved Class II Permeable Material. Crushed rock or aggregate base cannot be used within the treatment area, in, around or under the drain rock layer.
 - 4. Care shall be exercised to prevent natural or fill soils from intermixing with the drain rock surrounding the underdrain. All contaminated drain rock shall be removed and replaced with uncontaminated Class II permeable material.
 - 5. Attach subdrain piping to overflow structure.
 - 6. Install cleanouts at the ends of the subdrains. Install screw-on end caps set flush with the finished top of treatment soil.
- F. Overflow drain structure:
 - 1. Install overflow structure at the elevation and location specified on the plans. Attach subdrain piping to overflow structure. Attach solid pipe from overflow structure outfall storm drain system at elevation and slope indicated on the plans.
 - 2. Rim elevation of overflow structure must be set above the elevation of the top of treatment soil by the amount indicated on the plans, typically 6 inches.

Contractor shall verify that the rim elevation of the overflow structure is also a minimum of 2 inches below the lowest elevation of the treatment area perimeter so that storm flows will reach the overflow rim before the top of the treatment area perimeter.

3. The overflow structure shall have an open bottom filled with drain rock if indicated on the plans. This should be installed where the overflow structure has a sump condition (subdrains lower than the outfall invert elevation). The overflow structure shall be installed such that the bottom of the structure is set a minimum of 6-inches below the undisturbed bottom of the treatment area. Drain rock in the overflow sump shall be installed up to the invert of the lowest pipe connected to the structure.
- G. Filter media soil backfill
1. Filter soil of the approved specification shall be installed to the elevation indicated on the plans. Care should be taken to ensure that the soil is not compacted and that no equipment is driven on the backfill. Walking on the backfill should be limited to what is absolutely necessary.
- H. Planting soil, plantings, and mulch shall be installed per the plans. Non-floating bark / mulch shall be used, if indicated, to prevent removal of material and clogging of the overflow.
- I. Testing of the treatment area should be conducted once the filter media is installed and all storm drain piping is connected. The area should allow an infiltration rate well above 5 inches/ hour to ensure that the treatment area will continue to function at 5 inches/ hour over the lifetime of the treatment area.

3.6 PREFABRICATED COMPOSITE DRAINAGE PANELS

- A. Coordinate placement with other drainage materials.
- B. Install prefabricated drainage panels in accordance with manufacturer's instructions.
- C. Place perforated drainage pipe at base of footing and attach to composite drainage panels in accordance with the manufacturer's instructions.

3.7 JOINING PIPE

- A. Join PVC pipe and fittings with elastomeric seals according to ASTM D2321 or solvent cement.
- B. Special pipe couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.8 CLEANOUT INSTALLATION

- A. Cleanout piping to be the same size as the subdrain piping to which it is attached.

- B. Install cleanouts from subdrainage piping to grade. Locate cleanouts at beginning of piping run, at changes in direction, and other locations indicated.
- C. Do not allow cleanout box to bear on cleanout riser.

3.9 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

3.10 RETAINING WALL DRAINAGE

- A. Unless otherwise specified, drain system should consist of a minimum of 12 inches thick free-draining granular materials containing less than five percent fines passing a No. 200 sieve placed adjacent to the wall. Free-draining granular material should be graded to prevent the intrusion of fines or encapsulated in a suitable filter fabric. As an alternative, a prefabricated drainage structure, such as geo-composite, or approved equivalent, may be used as a substitute for the granular backfill adjacent to the wall.
- B. Drainage system consisting of either weep holes or perforated drain lines (minimum 4 inch diameter placed near the base of the wall) should be used to intercept and discharge water which would tend to saturate the backfill. Where used, drain lines should be embedded in a uniformly graded filter material and provided with adequate clean-outs for periodic maintenance.
- C. An impervious soil should be used in the upper one foot layer of backfill to reduce the potential for water infiltration.

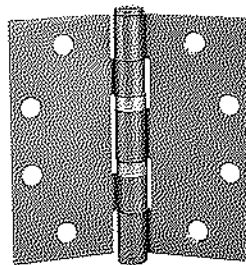
END OF SECTION

Five Knuckle Standard Weight Series

Recommended for standard weight, medium frequency doors, or doors with closing devices.

- Use for common flush door/frame/wall applications
- For Beveled Edge, where doors are beveled on hinge side, specify TA4314 or TA4714
- For available finishes see page 28

TA2314
TA2714



No.	ANSI Cross Reference	Base Material	Weight
TA2314	A5112	Stainless	STD
TA2314	A2112	Brass	STD
TA2714	A8112	Steel	STD

Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
3 1/2" x 3 1/2"*	88.9 x 88.9	.123	6	1/2 x 10-24	1 x 10
4" x 4"*	101.6 x 101.6	.130	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4"	114.3 x 101.6	.134	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4 1/2"	114.3 x 114.3	.134	8	1/2 x 12-24	1 1/4 x 12
5" x 4 1/2"*	127 x 114.3	.146	8	1/2 x 12-24	1 1/4 x 12
5" x 5"*	127 x 127	.146	8	1/2 x 12-24	1 1/4 x 12
6" x 6"*	152.4 x 152.4	.160	10	1/2 x 1/4-20	1 1/2 x 14

* Not available in Brass base material.

Options:

Code	Description
NRP	Non-Removable Pin
TB	Ball Bearing
TCA	Concealed Bearing
RC	Round Corner – 1/4" radius furnished unless specified otherwise
HT	Hospital Tip
BT	Ball Tip
FT	Flat Tip*

Code	Description
GT	Grooved Tip*
LT	Lined Tip*
RT	Round Tip*
ST	Steeple Tip
SSF	Safety Stud Feature
CC	Concealed Circuit – 4, 8, or 12 wire available

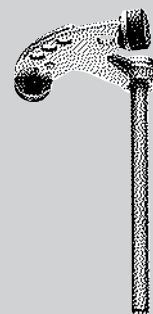
Code	Description
CC-18	Concealed Circuit – 2, 4, 6, 8 or 10 wire available (2-18AWG wires and the remainder 28AWG wires)
MM	Magnetic Monitoring
QC	ElectroLynx® Hinge – 4, 8 or 12 wire available

*Not available on 3-1/2" and 6" sizes

McKinney Hinge Pin Door Stop

- Recommended for high-use or high impact doors with McKinney T2714 or TA2714 hinges
- Protects against damage to doors and walls
- Runs the full length of the hinge

Part number	Description	Finish
76305	Hinge Pin Stop for MacPro MP79 & MPB79	26D
76306	Hinge Pin Stop for McKinney T2714 & TA2714	26D



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Hinge Pins

Pins, by design, are non-rising.



Two Knuckle

Pins on bearing hinges are furnished in stainless steel.



Three Knuckle

Pin stems in all non-ferrous bearing hinges are stainless steel.
Pins in all ferrous hinges are steel.



Five Knuckle

Pins on all non-ferrous bearing hinges are stainless steel with button tips.

Pins on all ferrous hinges are steel.

Non-Removable Pins

NRP

A set screw is driven into the barrel of the hinge that is inaccessible when the door is in the closed position. To order, add the suffix "NRP" to the hinge number.

NRD

Two knuckle hinges are available with a non-removable pin which features a dowel which is force fitted into the jamb leaf. When the door is hung, the pin is completely concealed and impossible to remove. One doweled hinge is usually furnished per set of three. To order, add the suffix "NRD" to the hinge number.

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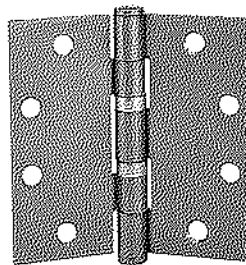
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Five Knuckle Standard Weight Series

Recommended for standard weight, medium frequency doors, or doors with closing devices.

- Use for common flush door/frame/wall applications
- For Beveled Edge, where doors are beveled on hinge side, specify TA4314 or TA4714
- For available finishes see page 28

TA2314
TA2714



No.	ANSI Cross Reference	Base Material	Weight
TA2314	A5112	Stainless	STD
TA2314	A2112	Brass	STD
TA2714	A8112	Steel	STD

Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
3 1/2" x 3 1/2"*	88.9 x 88.9	.123	6	1/2 x 10-24	1 x 10
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5" x 4 1/2"*	127 x 114.3	.146	8	1/2 x 12-24	1 1/4 x 12
5" x 5"*	127 x 127	.146	8	1/2 x 12-24	1 1/4 x 12
6" x 6"*	152.4 x 152.4	.160	10	1/2 x 1/4-20	1 1/2 x 14

* Not available in Brass base material.

Options:

Code	Description
NRP	Non-Removable Pin
TB	Ball Bearing
TCA	Concealed Bearing
RC	Round Corner – 1/4" radius furnished unless specified otherwise
HT	Hospital Tip
BT	Ball Tip
FT	Flat Tip*

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SSF	Safety Stud Feature
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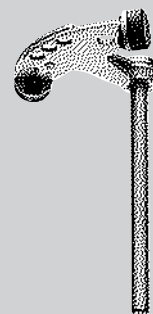
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*Not available on 3-1/2" and 6" sizes

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- Protects against damage to doors and walls
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Part number	Description	Finish
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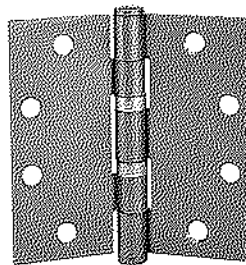
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TA2314
TA2714



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Options:

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TCA	Concealed Bearing
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BT	Ball Tip
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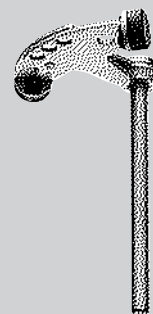
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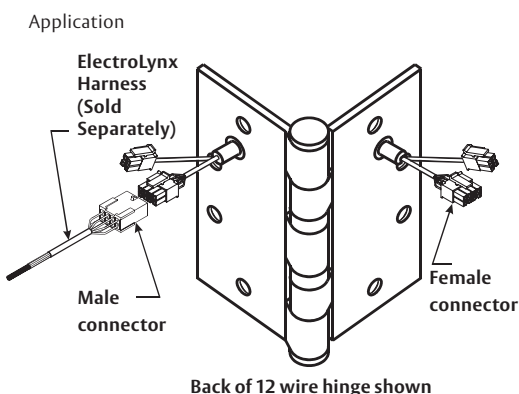
ElectroLynx® Hinge (QC option)

Each hinge features concealed plug connectors that eliminate the need for separate or exposed wiring. Standard connectors make installation quick and simple. Brass eyelets add protection and durability.

- The QC option is available on standard and heavy weight full mortise bearing hinges as well as swing clear and wide throw hinges
- Electric hinges allow a constant flow of current from the power source through the hinge to electrified door hardware. No external wires can be seen, eliminating tampering and improving the aesthetics of the door opening
- Materials: brass, stainless steel, and steel
- For 4 amp continuous @ 24 volts AC or DC per circuit, 28 gauge multi-strand wires are used.
- An 8 position connector is used for QC4 and QC8 wire hinges. An 8 position and a 4 position connector is used for QC12 wire hinges.
- Hand of hinge must be specified on two knuckle hinges
- Can be used in conjunction with MM option on most full mortise hinges. QC12 x MM not recommended for wood or solid core doors
- Full Mortise QC hinges are available in most BHMA and McKinney powder coat finishes
- Wires are coordinated to work with other ASSA ABLOY Group brands electro-mechanical hardware

*Electric hinges should be installed in the center position on the door. Installation instructions are packed with each hinge.

*Hinges are factory tested and specially packaged to minimize against damage during shipment.



Back of 12 wire hinge shown

Options:

Code	Description
QC4	2 circuits
QC8	4 circuits
QC12	6 circuits

3-Knuckle	5-Knuckle
TA314	TA2314
TA714	TA2714
TA386	T4A3386
TA786	T4A3786
	TA2895
	T4A3395
	T4A3795



Most hinges including this Swing Clear Hinge can be electrically modified. Call 1-800-346-7707 for more information.

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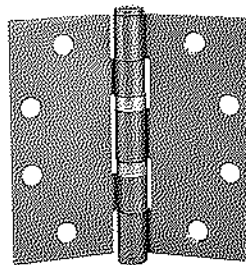
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- For available finishes see page 28

TA2314
TA2714



No.	ANSI Cross Reference	Base Material	Weight
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TA2314	A2112	Brass	STD
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* Not available in Brass base material.

Options:

Code	Description
NRP	Non-Removable Pin
TB	Ball Bearing
TCA	Concealed Bearing
RC	Round Corner – 1/4" radius furnished unless specified otherwise
HT	Hospital Tip
BT	Ball Tip
FT	Flat Tip*

Code	Description
GT	Grooved Tip*
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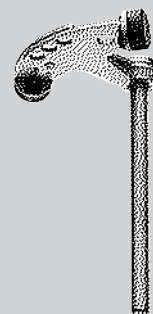
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Five Knuckle Heavy Weight Full Mortise Series

Recommended for use on high frequency and/or heavy wood or metal doors in schools, hospitals or other public buildings where heavy traffic is experienced.

- Heavy weight hinges should be used on all extra heavy doors or those exposed to high frequency use
- T4A3386- Stainless steel base or available in brass base material polished
- T4A3786- Steel base material
- For Beveled Edge, where doors are beveled on hinge side, specify T4A4386 or T4A4786
- For available finishes see page 28

Note: 8" x 6" and 8" x 8" have six bearings. Specify T6B3386 or T6B3786.

No.	ANSI Cross Reference	Base Material	Weight
T4A3386	A5111	Stainless	HVY
T4A3386	A2111	Brass	HVY
T4A3786	A8111	Steel	HVY

Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
4 1/2" x 4"	114.3 x 101.6	.180	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4 1/2"	114.3 x 114.3	.180	8	1/2 x 12-24	1 1/4 x 12
5" x 4 1/2"	127 x 114.3	.190	8	1/2 x 12-24	1 1/4 x 12
5" x 5"*	127 x 127	.190	8	1/2 x 12-24	1 1/4 x 12
6" x 5"*	152.4 x 127	.203	10	1/2 x 1/4-20	1 1/2 x 14
6" x 6"*	152.4 x 152.4	.203	10	1/2 x 1/4-20	1 1/2 x 14
8" x 6"***	203.2 x 125.4	.203	16	1/2 x 1/4-20	1 1/2 x 14
8" x 8"****	203.2 x 203.2	.203	16	1/2 x 1/4-20	1 1/2 x 14

* Not available in brass base material.

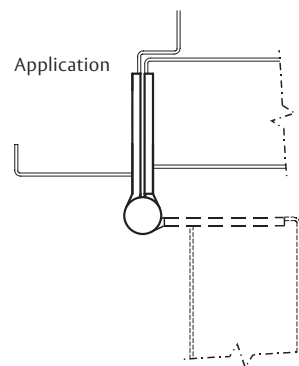
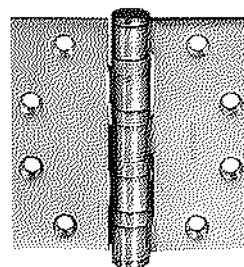
** Available in steel only.

***Available in stainless steel only.

****FT tips not offered on 6" and 8" sizes, BT and ST not offered on 8" sizes.

T4A3386

T4A3786



Options:

Code	Description
NRP	Non-Removable Pin
T4B	Ball Bearing
TCA	Concealed Bearing
RC	Round Corner – 1/4" radius furnished unless specified otherwise
HT	Hospital Tip
BT****	Ball Tip
FT****	Flat Tip
ST****	Steeple Tip
SSF	Safety Stud Feature
RB	Raised Barrel*
QC	ElectroLynx® Hinge – 4, 8 or 12 wire available
CC	Concealed Circuit – 4, 8 or 12 wire available
CC-18	Concealed Circuit – 2, 4, 6, 8 or 10 wire available (2-18AWG wires and the remainder 28AWG wires)
MM	Magnetic Monitoring

* Refer to page SP-3 for Raised Barrel.

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FM-11

Five Knuckle Heavy Weight Full Mortise Series

Recommended for use on high frequency and/or heavy wood or metal doors in schools, hospitals or other public buildings where heavy traffic is experienced.

- Heavy weight hinges should be used on all extra heavy doors or those exposed to high frequency use
- T4A3386- Stainless steel base or available in brass base material polished
- T4A3786- Steel base material
- For Beveled Edge, where doors are beveled on hinge side, specify T4A4386 or T4A4786
- For available finishes see page 28

Note: 8" x 6" and 8" x 8" have six bearings. Specify T6B3386 or T6B3786.

No.	ANSI Cross Reference	Base Material	Weight
T4A3386	A5111	Stainless	HVY
T4A3386	A2111	Brass	HVY
T4A3786	A8111	Steel	HVY

Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
4 1/2" x 4"	114.3 x 101.6	.180	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4 1/2"	114.3 x 114.3	.180	8	1/2 x 12-24	1 1/4 x 12
5" x 4 1/2"	127 x 114.3	.190	8	1/2 x 12-24	1 1/4 x 12
5" x 5"*	127 x 127	.190	8	1/2 x 12-24	1 1/4 x 12
6" x 5"*	152.4 x 127	.203	10	1/2 x 1/4-20	1 1/2 x 14
6" x 6"*	152.4 x 152.4	.203	10	1/2 x 1/4-20	1 1/2 x 14
8" x 6"***	203.2 x 125.4	.203	16	1/2 x 1/4-20	1 1/2 x 14
8" x 8"****	203.2 x 203.2	.203	16	1/2 x 1/4-20	1 1/2 x 14

* Not available in brass base material.

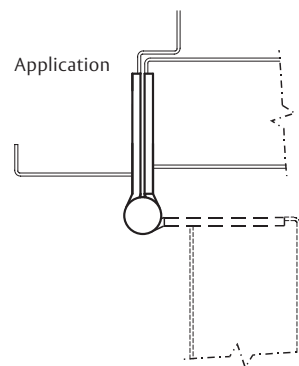
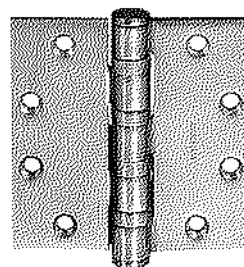
** Available in steel only.

***Available in stainless steel only.

****FT tips not offered on 6" and 8" sizes, BT and ST not offered on 8" sizes.

T4A3386

T4A3786



Options:

Code	Description
NRP	Non-Removable Pin
T4B	Ball Bearing
TCA	Concealed Bearing
RC	Round Corner – 1/4" radius furnished unless specified otherwise
HT	Hospital Tip
BT****	Ball Tip
FT****	Flat Tip
ST****	Steeple Tip
SSF	Safety Stud Feature
RB	Raised Barrel*
QC	ElectroLynx® Hinge – 4, 8 or 12 wire available
CC	Concealed Circuit – 4, 8 or 12 wire available
CC-18	Concealed Circuit – 2, 4, 6, 8 or 10 wire available (2-18AWG wires and the remainder 28AWG wires)
MM	Magnetic Monitoring

* Refer to page SP-3 for Raised Barrel.

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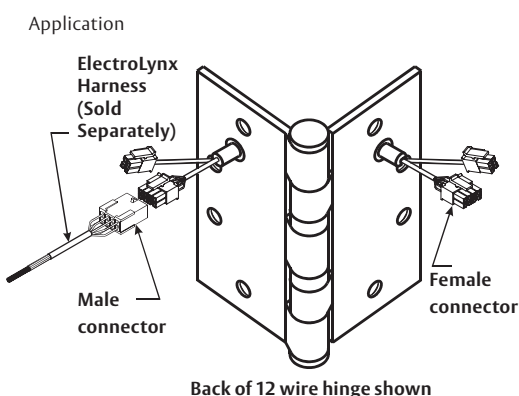
ElectroLynx® Hinge (QC option)

Each hinge features concealed plug connectors that eliminate the need for separate or exposed wiring. Standard connectors make installation quick and simple. Brass eyelets add protection and durability.

- The QC option is available on standard and heavy weight full mortise bearing hinges as well as swing clear and wide throw hinges
- Electric hinges allow a constant flow of current from the power source through the hinge to electrified door hardware. No external wires can be seen, eliminating tampering and improving the aesthetics of the door opening
- Materials: brass, stainless steel, and steel
- For 4 amp continuous @ 24 volts AC or DC per circuit, 28 gauge multi-strand wires are used.
- An 8 position connector is used for QC4 and QC8 wire hinges. An 8 position and a 4 position connector is used for QC12 wire hinges.
- Hand of hinge must be specified on two knuckle hinges
- Can be used in conjunction with MM option on most full mortise hinges. QC12 x MM not recommended for wood or solid core doors
- Full Mortise QC hinges are available in most BHMA and McKinney powder coat finishes
- Wires are coordinated to work with other ASSA ABLOY Group brands electro-mechanical hardware

*Electric hinges should be installed in the center position on the door. Installation instructions are packed with each hinge.

*Hinges are factory tested and specially packaged to minimize against damage during shipment.



Back of 12 wire hinge shown

Options:

Code	Description
QC4	2 circuits
QC8	4 circuits
QC12	6 circuits

3-Knuckle	5-Knuckle
TA314	TA2314
TA714	TA2714
TA386	T4A3386
TA786	T4A3786
	TA2895
	T4A3395
	T4A3795



Most hinges including this Swing Clear Hinge can be electrically modified. Call 1-800-346-7707 for more information.

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Five Knuckle Heavy Weight Full Mortise Series

Recommended for use on high frequency and/or heavy wood or metal doors in schools, hospitals or other public buildings where heavy traffic is experienced.

- Heavy weight hinges should be used on all extra heavy doors or those exposed to high frequency use
- T4A3386- Stainless steel base or available in brass base material polished
- T4A3786- Steel base material
- For Beveled Edge, where doors are beveled on hinge side, specify T4A4386 or T4A4786
- For available finishes see page 28

Note: 8" x 6" and 8" x 8" have six bearings. Specify T6B3386 or T6B3786.

No.	ANSI Cross Reference	Base Material	Weight
T4A3386	A5111	Stainless	HVY
T4A3386	A2111	Brass	HVY
T4A3786	A8111	Steel	HVY

Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
4 1/2" x 4"	114.3 x 101.6	.180	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4 1/2"	114.3 x 114.3	.180	8	1/2 x 12-24	1 1/4 x 12
5" x 4 1/2"	127 x 114.3	.190	8	1/2 x 12-24	1 1/4 x 12
5" x 5"*	127 x 127	.190	8	1/2 x 12-24	1 1/4 x 12
6" x 5"*	152.4 x 127	.203	10	1/2 x 1/4-20	1 1/2 x 14
6" x 6"*	152.4 x 152.4	.203	10	1/2 x 1/4-20	1 1/2 x 14
8" x 6"***	203.2 x 125.4	.203	16	1/2 x 1/4-20	1 1/2 x 14
8" x 8"****	203.2 x 203.2	.203	16	1/2 x 1/4-20	1 1/2 x 14

* Not available in brass base material.

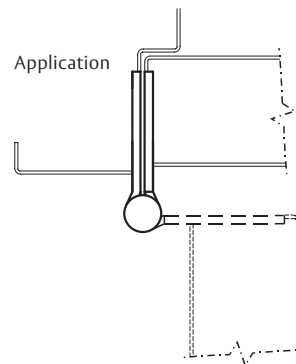
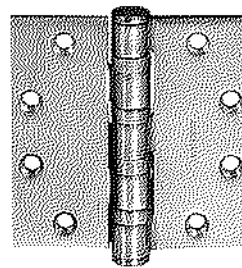
** Available in steel only.

*** Available in stainless steel only.

**** FT tips not offered on 6" and 8" sizes, BT and ST not offered on 8" sizes.

T4A3386

T4A3786



Options:

Code	Description
NRP	Non-Removable Pin
T4B	Ball Bearing
TCA	Concealed Bearing
RC	Round Corner – 1/4" radius furnished unless specified otherwise
HT	Hospital Tip
BT****	Ball Tip
FT****	Flat Tip
ST****	Steeple Tip
SSF	Safety Stud Feature
RB	Raised Barrel*
QC	ElectroLynx® Hinge – 4, 8 or 12 wire available
CC	Concealed Circuit – 4, 8 or 12 wire available
CC-18	Concealed Circuit – 2, 4, 6, 8 or 10 wire available (2-18AWG wires and the remainder 28AWG wires)
MM	Magnetic Monitoring

* Refer to page SP-3 for Raised Barrel.

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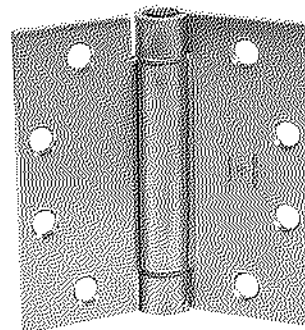
FM-11

Standard Weight Spring Hinge

Recommended for standard weight, medium frequency doors in place of door closers in apartments, hotels, motels, office buildings, etc.

- Spring hinges are an alternative to door closing devices. For maximum performance it is recommended to use all spring hinges on the door.
- This non-handed spring hinge series is adjustable and tension can be added or reduced by means of a hex key that is provided
- Caution: Use of gasketing for smoke or sound protection, wind conditions or unbalanced air pressure, twisted or misaligned frames or doors, door bottoms, improper latch adjustment may prevent doors from latching. Additional spring hinges may be required.
- For available finishes see page 28

1502
1552

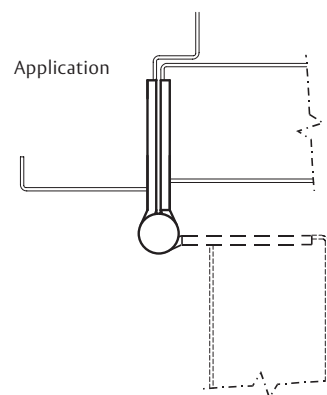


No.	ANSI Cross Reference	Base Material	Weight
1502	K81081	Steel	STD
1502	K81081F	Steel	STD
1552	K51071	Stainless Steel	STD
1552	K51071F	Stainless Steel	STD

Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
4" x 4"*	101.6 x 101.6	.130	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4"	114.3 x 101.6	.134	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4 1/2"	114.3 x 114.3	.134	8	1/2 x 12-24	1 1/4 x 12

*Not available in 1552.



Options:

Code	Description
RC	Round corner - 1/4" radius furnished unless specified otherwise

Residential Spring Hinges

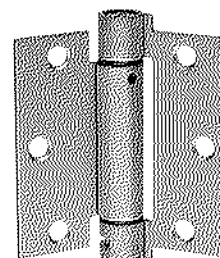
Designed for light weight, self-closing doors.

Used as an alternative to door closing devices, this hinge is made of residential grade material making it a perfect fit for multi-family housing and similar applications. Generally two spring hinges must be used in order to provide the force needed to close the door.

The 3 $\frac{1}{2}$ " hinge is available as the 1552 stainless steel version or the 1502 steel hinge which is offered in a variety of finishes.

Part number	Description	Finish
155880	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	3
155881	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	4
155882	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	10
155883	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	10A
155884	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	10B
155884E	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	10BE
155885	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	15
155886	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	26
155887	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	26D
155888	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	D4
155889	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1502	P
155890	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1552	32D

3 $\frac{1}{2}$ x 3 $\frac{1}{2}$
1502



Specifications

Inches	mm	Gauge	No. of Holes	Fasteners Wood	Fasteners Metal
3 $\frac{1}{2}$ " x 3 $\frac{1}{2}$ "	88.9 x 88.9	.106	6	#10 x 1 $\frac{1}{4}$ "	#10-24 x $\frac{1}{2}$ "

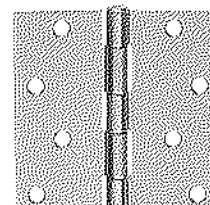
Residential Hinges

For light weight doors.

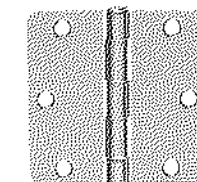
For Multi-family and residential applications. Rounded or square corners. Consult the factory for availability of other finishes.

Part number	Description	Finish	Corners
56689	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1400	4	Square
56868	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1458	26D	$\frac{5}{8}$ " radius
56870	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1458	3	$\frac{5}{8}$ " radius
56288	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1400	26D	Square
56281	3 $\frac{1}{2}$ x 3 $\frac{1}{2}$ 1414	26D	$\frac{1}{4}$ " radius
56748	4 x 4 1400	26D	Square

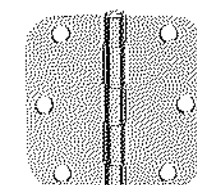
4 x 4
1400



3 $\frac{1}{2}$ x 3 $\frac{1}{2}$
1414



3 $\frac{1}{2}$ x 3 $\frac{1}{2}$
1458



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What is PemkoHinge®?

PemkoHinge® consists of two full-height, paired and geared leaves. Each geared leaf rotates evenly from top to bottom riding on proprietary polymer blended bearings. The geared leaves and bearings are held together by a full-length channel cap. This assembly retains the smooth, clean lines of the door and frame, while easily supporting heavy vertical loads.

PemkoHinge®

SECURITY, SAFETY, PRIVACY, LOW WEAR AND TEAR

PemkoHinge® Attributes:

- With a continuous hinge, typical alignment problems (such as door sag and binding) are eliminated
- The continuous hinge distributes load stress uniformly along the full length of the door and frame
- The gear design of the continuous hinge ensures symmetrical operation of each leaf
- ½ lb. or less operating force required to operate most doors, regardless of size
- Low operating force feature makes continuous hinges ideal for doors used by the physically challenged
- The continuous hinge, when installed on standard steel doors and frames, requires no additional reinforcement. However, hinge preps must have fillers installed for proper operation
- A high degree of security can be achieved for exterior openings or restricted spaces by using a continuous hinge. With the geared construction and the full-length channel cap, the common gap between the door and frame is sealed, which provides security against prying
- In addition, the continuous full-height hinge cap protects against pinching fingers in doors in public areas, particularly those where children are present
- Sight proof design of the continuous hinge provides privacy for lavatories, executive offices, or file rooms

PemkoHinge® Superior Design:

- PemkoHinge® has increased critical stress points of the hinge leaf extrusions providing additional strengths and rigidity to the completed product
- PemkoHinge® bearing design eliminates premature wear, guarantees proper alignment, and requires fewer bearings to carry more weight. The bearing is produced for Pemko using a chemical composition and injection process that provides a stronger, more accurately formed bearing
- PemkoHinge® is designed with inter-meshing gear segments in the hinge which provide 50% more bearing surface resulting in less wear
- PemkoHinge® goes through the anodizing process after completing all machining. This means the machined aluminum surfaces that are in direct contact with the bearing have a smoother, harder surface, thereby reducing wear
- PemkoHinge® maintains uniform bearing spacing for the full length of the hinge even when lengths exceed 10'
- PemkoHinge® uses #12-24 size fasteners with #10 head (#12 Tek fasteners available upon request)
- PemkoHinge® commercial models are ideal for use on lead lined doors (i.e. hospital X-ray rooms), without requiring special screw locations

How To Order (Hinge Part Designations)

Example: D | SPFM | 85 | SLI | HD1

Finishes		Hinge Types		Lengths	Hinge Options		Capacity	
BL	Black Anodized	FM	Full-Mortise	79	"blank"	Standard	"blank"	Standard Duty
C	Clear Anodized	FS	Full-Surface	83	CP	Center Pivot	HD1	Heavy Duty, Grade 1
D	Dark Bronze Anodized	HS	Half-Surface	85	RG	Raised Gear	HD3	Heavy Duty, Grade 3
G	Gold Anodized	RS138	Full-Mortise Residential: 1 ³ / ₈ "	95	SF	Safety		
PW	Painted White	RS175	Full-Mortise Residential: 1 ³ / ₄ "	120	SL	Short Leaf (residential only)		
SN	Satin Nickel Anodized	SPFM	Special Full-Mortise		SLF	Short Leaf Flush		
		WT_FM	Wide Throw Full-Mortise		SLI	Short Leaf Inset		
		WT_HS	Half-Surface					

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BHMA Certification Program

This program was developed to establish product classifications through performance testing. Three grades (1, 2 and 3) of product classifications were established for continuous hinges, with three weight groups (150, 300 and 600) for each grade: Grade 3 being the lowest and Grade 1 being the highest classification. Each classification and weight group has a set of established cycle requirements and wear characteristics, with a minimum for vertical and lateral wear to establish a listing under a weight and grade classification, after the set number of cycles is completed.

Maximum Vertical Wear Allowable:

Grade 3 = 0.105"

Grade 2 = 0.030"

Grade 1 = 0.020"

Maximum Lateral Wear Allowable:

All Grades = 0.062"

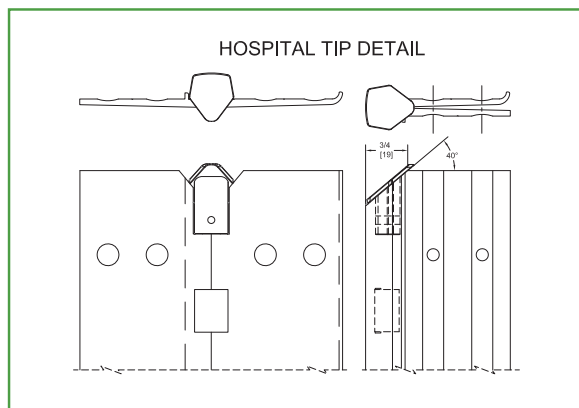
Cycle requirements range from Grade 3-600 requiring 100,000 cycles through Grade 1-150 requiring 2.5 million cycles.

For more information on certification testing or other product certification programs, please contact Pemko Customer Service.



Hospital Tip

A special modification is available for certain hinges which provides a Hospital Tip Cap at the top of the gear cap, leaving no opening. A 45° angled cut on the gear cap and leaf covers provides a safe environment for hospitals and correctional facilities.



Cycle Requirements - Per BHMA Standard ANSI/BHMA A156.26-2012

- Standard Duty Hinges (excluding _RS175 & _RS138) conform to Grade 3-150 and Grade 3-300
- HD3 Hinges conform to Grade 3-150, Grade 3-300, and Grade 3-600
- HD1 Hinges conform to Grade 2-150, Grade 1-300, and Grade 1-600
- 1100 Series and X-Series Hinges conform to Grade 1-150

Weight Bearing - Per BHMA Standard ANSI/BHMA A156.26-2012

- This information pertains to all commercial models
- Heavier weight can be carried; please contact Customer Service for applications other than those listed in the chart
- Special hinge reinforcements are not required as hollow metal door and frame manufacturers' standard are acceptable. Removal of hinge reinforcements in the door and frame is not advised. Hinge preps must have fillers installed

UL Fire Labeled 1½ & 3 Hour



LISTED
DOOR HINGE
76Y2

- All models designated with these symbols are tested and certified by Underwriters Laboratories Inc.® (U.S.A. and Canada) to standards UL10B, UL10C and UBC7.2 (positive pressure) for a 1½-Hour Fire Listing for all 4'0" x 10'0" and 8'0" x 10'0" door and frame assemblies. Fire listing certifications apply to all approved hollow metal and wood door assemblies in drywall or masonry wall construction
- Special FirePins™ are only required on 3-Hour assemblies. Please refer to page 95 for illustrations and information regarding the application of Pemko FirePins™

- All hinges are supplied with standard fastener kits. Replacement kits/individual fasteners may be purchased separately
- TEK/TORX fasteners may be purchased separately. Full-mortise hinges require 40 each; half-surface hinges require 20 each; full-surface hinges require 12 each
- All half-surface and full-surface hinges are supplied with a snap cover for the door leaf. Replacement snap covers may be purchased separately
- Rain caps may be purchased separately

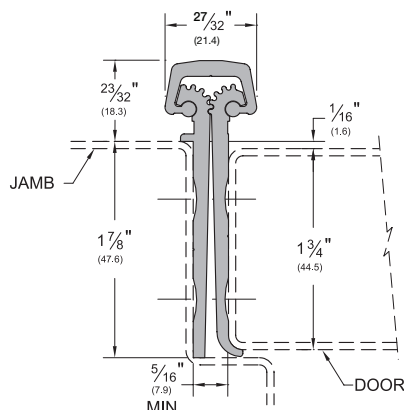
Full Mortise Hinges

- Full-Mortise units are designed mainly for new door applications and are applied to the frame rabbet and door edge to conceal both leaves

Full Mortise

_FM

STANDARD FINISHES: C, D

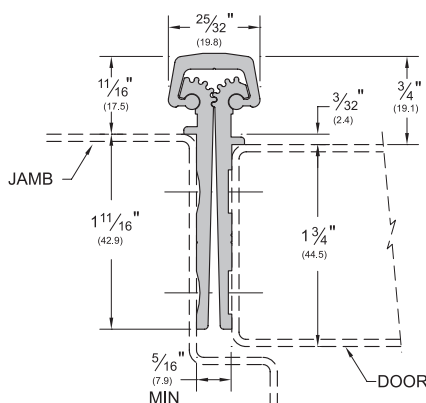


Full Mortise Short Leaf Inset

- Designed for use with doors which range between 1 3/4" to 2 1/4"
- Designed for use with hollow metal doors and frames where the inset conforms to S.D.I. specifications for aligning doors and frames

_FM_SLI

STANDARD FINISHES: C, D

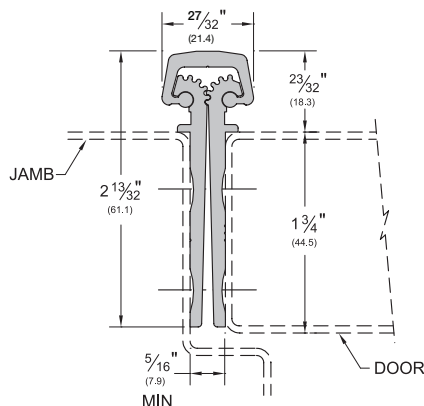


Full Mortise Short Leaf Flush

- Designed for use with doors which range between 1 3/4" to 2 1/4"
- Also used for bifold applications to keep the faces of the doors flush (not illustrated)

_FM_SLF

STANDARD FINISHES: C, D



OPTIONAL FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)

BL (Black Anodized) G (Gold Anodized)

PW (Painted White) and SN (Satin Nickel) are special finishes available upon request.

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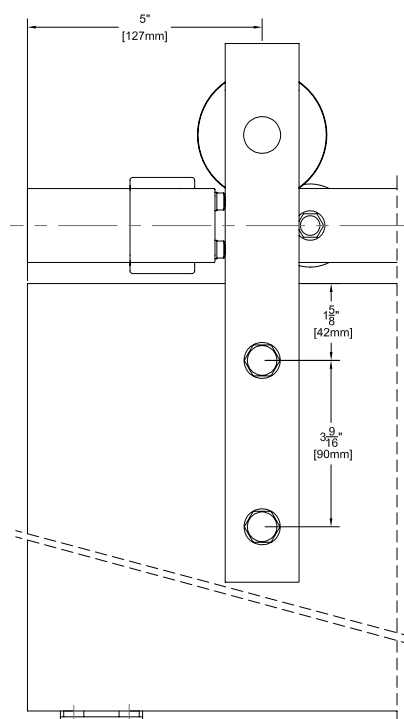
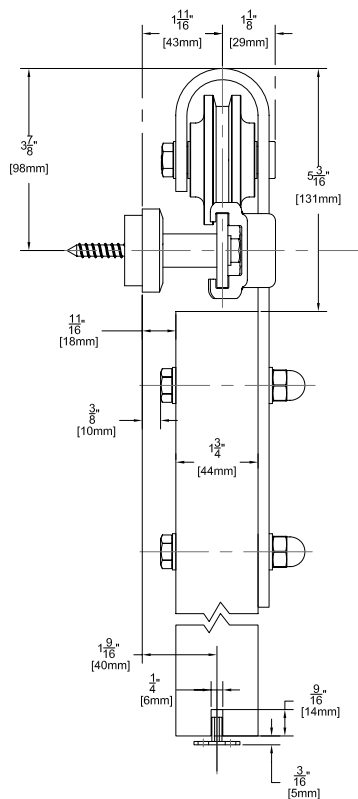
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Builders Series Flat Track Sliding Door Hardware System

BLD-FT-01 for Wood Doors

For Sliding Panels up to 240 lbs.



Configurations:

- Single
- Bi-parting

Installations:

- Side Wall Mount (only)

Features:

- Solid nylon wheel for smooth operation
- 240 lb. panel capacity
- 5 year warranty

Finishes:

- Black Suede Powder Coated Steel (BLD-FT-01BS)
- Industrial Steel Zinc Coated Steel (BLD-FT-01IS)

BLD-FT-01 Kits Include:

- 1 ea **BLD-FT_/_** Steel Flat Track
- 5 ea **BLD-99_** Steel Track Brackets
- 2 ea **BLD-01_** Steel Strap Mount Hangers
- 2 ea **BLD-77** Anti-Rise Discs
- 1 ea **102N** Mortised Type Nylon Guide
- 2 ea **BLD-11_** Steel Track Stops Mounting Hardware

Standard Kit Sizes

Part Number	Material	Track Length	Door Width
BLD-FT-01IS/6	Industrial Steel	72"	36"
BLD-FT-01IS/8	Industrial Steel	96"	48"
BLD-FT-01BS/6	Black Suede Powder Coated Steel	72"	36"
BLD-FT-01BS/8	Black Suede Powder Coated Steel	96"	48"

Options: See page 275

Bottom Channel

94A

Roller Guide

106R/94

Side Wall Mortised Type Guide

102WN-KIT

Polypropylene Guide Rail

EPD3BL For Use With 102N

5/8" Spacer

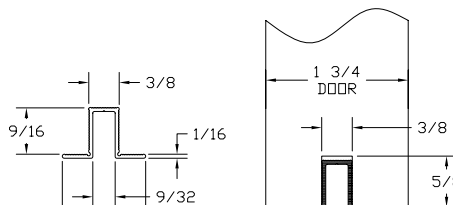
BLD-SPACER-58 Pack of 5 5/8" Spacer Recommended for use with 5/8" Gypsum Board When Mounting Track Directly to Gypsum Board

1/2" Spacer

BLD-SPACER-12 Pack of 5 1/2" Spacer Recommended for use with 1/2" Gypsum Board When Mounting Track Directly to Gypsum Board

3/8" Spacer

BLD-SPACER-38 Pack of 5 3/8" Spacer Recommended for use with 3/8" Gypsum Board When Mounting Track Directly to Gypsum Board



NOTE: Alternate route dimension when using optional EPD3BL

800-824-3018 | www.pemko.com

Check the web site for the up-to-date catalog

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ASSA ABLOY

The global leader in door opening solutions

POWER »» PRODUCTS

SMART
MAGNALOCKS

DURABLE
MAGNALOCKS

SPECIALTY
LOCKS

EXIT
DEVICES

ENTRY
DEVICES

ACCESS CONTROL
ACCESSORIES

POWER
SUPPLIES

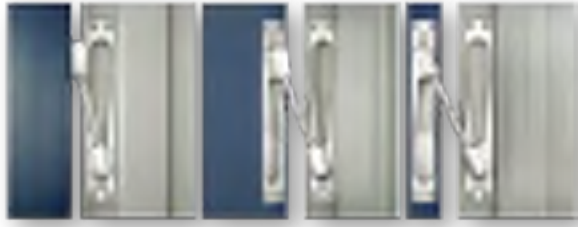
POWER
TRANSFER

POWER
ACCESSORIES

RESOURCES

SECURITRON®
ASSA ABLOY

ASSA ABLOY, the global leader in door opening solutions



PRODUCT FEATURES

- Mortises into the edges of the door and frame
- Direct retrofit for competitor products
- Tamper resistant
- All metal construction including back boxes
- 7/8" knockouts on back boxes accommodate EMF-type fittings
- Tested to 1,000,000 cycles
- Compatible with butt hinges up to 6" and continuous hinges with cutout
- MagnaCare® lifetime replacement, no fault warranty

PRODUCT OPTIONS

- CEPT-10 includes 8-22 AWG wires plus 2-18 AWG wires for higher-current devices
- CEPT-CSE includes CAT5E compatible with 9 - 22 AWG wire stranded conductor, Molex connectors
- EL-CEPT is ElectroLynx® compatible with 12-22 AWG wires, ElectroLynx® connectors

SPECIFICATIONS

- ANSI/UL 10C Listed, 3 hour rated
- ULC-S318 Listed, 3 hour rated
- ANSI/SDI-BHMA A250.13 (+/- 150 psi) Windstorm Listed
- Florida Building Code Approved
- Patents: 8,448,382; 2,714,685 (Canada)

Dimensions:
CEPT Housing
9-1/16"L x 1-3/16"W x 1-7/16"D

Shipping Weight:
2.40 lbs [1.09kg]

Finishes:
US32D/630 - Stainless Steel
US04/606 - Dull Brass
US10/612 - Dull Bronze
US10B/613 - Oil Rubbed Bronze



Technical note:

- Not for use with center hung or balanced doors, pocket or offset pivots or swing clear hinges.
- Door swing ranges when installed with butt hinges are :

Hinge Size	Door Swing Range
5" or less	up to 180
5-1/2"	up to 130
6" Butt Hinge	up to 110

CEPT

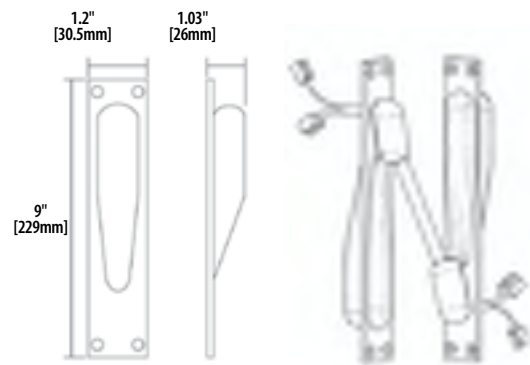
Concealed Electrical Power Transfer

Beautifully Crafted, Compact, Secure Power Transfer

The heavy-duty, tamper-resistant Concealed Electrical Power Transfer (CEPT) securely transfers power and data from the hinge side of the frame to electrified hardware on the door. The unit is discreetly concealed between the frame and door when the door is closed. Available in three multi-wire configurations and four finishes, the CEPT complements any architectural setting.

MODELS

	PART # Description
CEPT-10	CEPT - US32D, Concealed, 10 Wires
CEPT-10-04	CEPT - US04/606, Concealed, 10 Wires
CEPT-10-10	CEPT - US10/612, Concealed, 10 Wires
CEPT-10-10B	CEPT - US10B/613, Concealed, 10 Wires
CEPT-CSE	CEPT - US32D, Concealed, CAT-5E
CEPT-CSE-04	CEPT - US04/606, Concealed, CAT-5E
CEPT-CSE-10	CEPT - US10/612, Concealed, CAT-5E
CEPT-CSE-10B	CEPT - US10B/613, Concealed, CAT-5E
EL-CEPT	CEPT - Concealed, US32D, ElectroLynx®
EL-CEPT-04	CEPT - Concealed, US04/606, ElectroLynx®
EL-CEPT-10	CEPT - Concealed, US10/612, ElectroLynx®
EL-CEPT-10B	CEPT - Concealed, US10B/613, ElectroLynx®
CEPT-NW	CEPT - Without Wires





Automatic Flush Bolts No. 2840 (Automatic Top Bolt Only) No. 2842 (Set) (replaces the No. 1840 and No. 1842)

- Material:** Brass, stainless steel
- Finishes:** US3, US4, US10, US10B, US26, US26D, US32D
- Fastener:** No. 2842: 20 ea. #8 x 3/4" FH combo screws, 2 ea. #6-8 plastic anchors
No. 2840: 10 ea. #8 x 3/4" FH combo screws. NOTE: No plastic anchor required for top only
- Features:**
- For Fire Rated Metal Doors labeled A, B, C, D & E up to 4'w x 8'h
 - Non-handed
 - Fully automatic— opening active door retracts top and bottom bolts
 - Override feature prevents damage to doors or bolts if bolt heads are blocked from entering strikes
 - Bolt head rods are adjustable up to 1 1/2"
 - Thermal lock automatically locks the inactive door under high heat conditions due to fire
- Options:** No. 2842 can be used with the No. 570 Dust Proof Strike (shown on page E4).

No.	Size	Weight	ANSI A156.3
2840	1" x 6 3/4"	1.2 lbs.	Type 25
2842	1" x 6 3/4"	2.4 lbs.	Type 25



Combination Flush Bolts No. 2805 (Self Latching Top Bolt Only) No. 2845 (Set) (replaces No. 1805 and No. 1845)

- Material:** Brass, stainless steel
- Finishes:** US3, US4, US10, US10B, US26, US26D, US32D
- Fastener:** Top: 8 ea. #8 x 3/4" FH combo screws. NOTE: No plastic anchor required for top only.
Bottom (No. 2845 only) 18 ea. #8 x 3/4" FH combo screws, 2 ea. #6-8 plastic anchors.
- Features:**
- For Fire Rated Metal Doors labeled A, B, C, D & E up to 4'w x 8'h
- Top Bolt**
- Automatically engages when the inactive door closes. When the active door is opened, the inactive door stays latched at the top until the top bolt is released by pressing the plunger button on the bolt face
- Bottom Bolt (No. 2845 only)**
- Non-handed
 - Fully automatic — opening active door retracts bottom bolt
 - Override feature prevents damage to door or bolt if bolt head is blocked from entering strike
 - Bolt head rod is adjustable up to 1 1/2"
 - Thermal lock automatically locks the inactive door under high heat conditions due to fire
- Options:** No. 2845 can be used with the No. 570 Dust Proof Strike (shown on page E4)

No.	Size	Weight	ANSI A156.3
2805	1" x 6 3/4"	1.2 lbs.	Type 27
2845	1" x 6 3/4"	2.4 lbs.	Type 27

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door opening solutions

Automatic Flush Bolt No. 2940 (Automatic Top Bolt Only) No. 2942 (Set) (replaces No. 1840 and No. 1842)



Material: Brass, stainless steel

Finishes: US3, US4, US10, US10B, US26, US26D, US32D

Fastener: No. 2940: 6 ea. #8x³/₄" FH combo screws, 2 ea. #8-32x¹/₂" FH MS, 3 ea. #10x1" FH WS
NOTE: No plastic anchor required for top only.
No. 2942: 12 ea. #8x³/₄" FH combo screws, 4 ea. #8-32x¹/₂" FH MS, 6 ea. #10x1" FH WS, 2 ea. #6-8 plastic anchors

Features:

- For Wood Doors labeled B, C, D & E up to 4'w x 8"h
- Non-handed
- Fully automatic—opening active door retracts top and bottom bolts
- Override feature prevents damage to doors or bolts if bolt heads are blocked from entering strikes
- Bolt head rods are adjustable up to ¹/₂"
- Thermal lock automatically locks the inactive door under high heat conditions due to fire

Options: No. 2942 can be used with the No. 570 Dust Proof Strike (shown on page E4).

No.	Size	Weight	ANSI A156.3
2940	1" x 8 ¹ / ₂ "	1.5 lbs.	Type 25
2942	1" x 8 ¹ / ₂ "	2.9 lbs.	Type 25

Combination Flush Bolts No. 2905 (Self Latching Top Bolt Only) No. 2945 (Set) (replaces No. 1905 and No. 1945)



Material: Brass, stainless steel

Finishes: US3, US4, US10, US10B, US26, US26D, US32D

Fastener: Top: 4 ea. #8x³/₄" FH combo screws, 2 ea. #8-32x¹/₂" FH MS, 3 ea. #10x1" FH WS.
NOTE: No plastic anchor required for top only.
Bottom (No. 2945 only): 10 ea. #8x³/₄" FH combo screws, 4 ea. #8-32x¹/₂" FH MS, 6 ea. #10x1" FH WS, 2 ea. #6-8 plastic anchors

Features:

- For Wood Doors labeled B, C, D & E up to 4'w x 8'h

Top Bolt

- Automatically engages when the inactive door closes. When the active door is opened, the inactive door stays latched at the top until the top bolt is released by pressing the plunger button on the bolt face

Bottom Bolt (No. 2945 only)

- Non-handed
- Fully automatic — opening active door retracts bottom bolt
- Override feature prevents damage to door or bolt if bolt head is blocked from entering strike
- Bolt head rod is adjustable up to ¹/₂"
- Thermal lock automatically locks the inactive door under high heat conditions due to fire

Options: No. 2945 can be used with the No. 570 Dust Proof Strike (shown on page E4).

No.	Size	Weight	ANSI A156.3
2905	1" x 8 ¹ / ₂ "	1.5 lbs.	Type 27
2945	1" x 8 ¹ / ₂ "	2.9 lbs.	Type 27

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Lever Extension Flush Bolt With Bottom Fire Bolt No. 557 x 19BFB

- Material:** Flush bolt – brass
Bottom fire bolt – stainless steel
- Finishes:** Available in standard architectural finishes (see page 9)
- Fastener:** 7 ea. #8 x 3/4" FH combo screws
4 ea. #8 - 32 x 1/2" FH MS
4 ea. #8 counter sunk washer
- Features:**
- For Fire Rated Plastic & Wood Covered Fire Doors measuring up to 4'w x 9'h rated up to 20 minutes
 - 3/4" bolt throw, 3/4" backset; door strength maintained by corner reinforcing plate
 - When door is subjected to 230°F the plug and black plastic cover will melt allowing the bolt to project, locking the leaves together
 - Bottom fire bolt eliminates need for floor prep
 - Oversize fire bolt strike hole allows for slight door misalignment

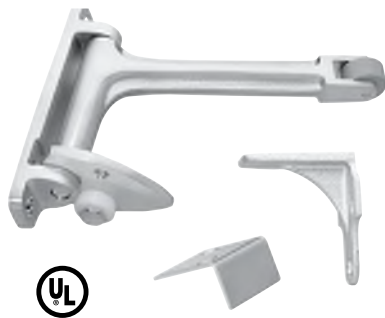
No.	Size	Weight
557 x 19BFB	Top bolt: 1" x 6 3/4" Bottom bolt: 1 3/16" dia.	0.9 lbs.



Dust Proof Strike No. 570

- Material:** Brass
- Finishes:** Available in standard architectural finishes (see page 9)
- Fastener:** Adjustment nut
Spanner wrench
2 ea. #8 x 1 OH SMS, 2 ea. plastic anchors
2 ea. #8 - 32 x 3/4" OH MS, 2 ea. lead anchors
- Features:**
- Works with all Rockwood manual and automatic flush bolts
 - Removable face plate for use with thresholds
 - Adjustable height for carpeted areas

No.	Size	Weight	ANSI A156.16
570	Face plate: 1 3/8" x 2 7/8" Barrel: 7/8" dia. x 2" depth	0.4 lbs.	L04021



Gravity Door Coordinator No. 576

- Material:** Cast brass
- Finishes:** Available in standard architectural finishes (see page 9).
- Fastener:** Body: 2 ea. #10 x 1" FH SMS, 2 ea. #10 - 24 x 1" FH MS
Strike: 5 ea. #8 x 1" FH SMS
- Other:**
- For use on door sizes:
 - with Astragal on active door – 18" to 48"
 - with Astragal on inactive door – 18" to 34"
 - with Astragal on both doors – 18" to 30"
 - The overlap of the astragal is maximum 7/8" with door hung on standard hinges. Customer must contact the factory for all other astragal situations
- Features:** Non-handed reversible. Prevents the active door from closing until the inactive door is closed

No.	Size	Projection	Weight	ANSI A156.3
576	1" x 5 7/16"	7"	2.2 lbs.	Type 21

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4015

Threshold Bolt

Security for pairs of doors with single key turn is possible with the 4015 Threshold Bolt. The two-point locking solution secures the entire double door entrance when working in conjunction with an MS® Deadlock.

Function

Adding the 4015 Threshold Bolt to a pivoted bolt MS® deadlock provides Maximum Security for pairs of doors with the turn of a single key. Simultaneously dropping a stainless steel hexbolt into the threshold and pivoting the massive MS® bolt into the mating door's stile, the two-point locking solution secures the entire entrance. The 4015 Threshold Bolt is harnessed to the rear of the pivoted bolt. It may be added to any basic MS1850S, MS1850SN, MS1950 Series deadlock.

Both the 4015 Threshold Bolt and the 4016 Header Bolt may be added to a pivoted bolt MS® deadlock to provide Maximum Security for pairs of doors by the turn of a single key. Simultaneously extending the stainless steel hexbolts into the threshold and header and pivoting the massive MS® bolt into the mating door's stile, thereby providing a three-point locking solution.

Operation

360° turn of key or thumbturn in basic MS® deadlock throws counterbalanced bolt into opposite door and drops bolt into threshold. Key can be removed only when bolts are in a positively locked or unlocked position.



Lock available separately



Aluminium



Hollow Metal

Features

Cylinder Height

Standard threshold bolt rod is sufficient for cylinder height up to 53-7/16" [1357.3 mm]. It is fully threaded and can be cut off for low cylinder heights. Please contact factory for rods pre-cut to specific cylinder heights, available by special order for high volume applications.

Adjustment

Exact adjustment of threaded rod to cylinder heights is locked in place by hexagonal threshold bolt.

Strike

For drop-bolt, a 1/2" [12.7 mm] diameter hole in metal threshold is suitable. For non-metal installation, 4005 Strike is available separately.

Threshold Bolt

Hexagonal 3/8" [9.5 mm] flat to flat. Made of stainless steel.

Standard Package

Packed separately with bolt guide, screws, and attachment pin.

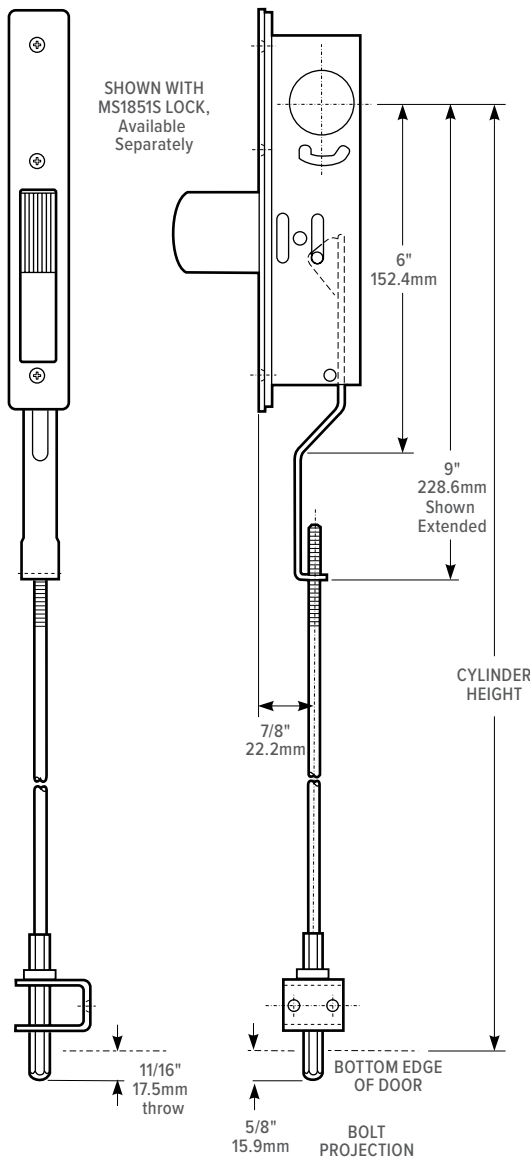
Shipping Weight

1 lb [0.45 kg].

Options

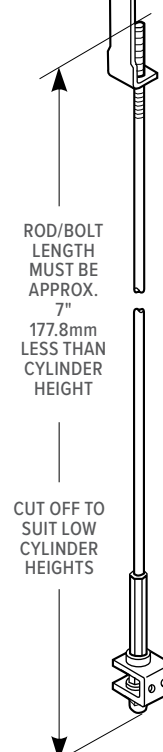
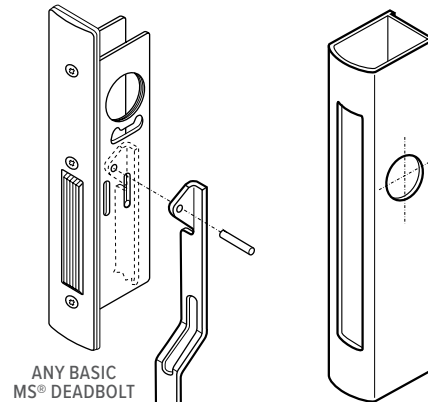
- For "universal" application, specify 4015-18-1B with fully threaded rod for cut off to any cylinder heights below 53" [1346.2 mm]. Please contact factory for cylinder height greater than 53" [1346.2 mm] to maximum 60" [1524mm] or to specify rods pre-cut to specific cylinder heights available by special order for high volume applications.

Dimensions



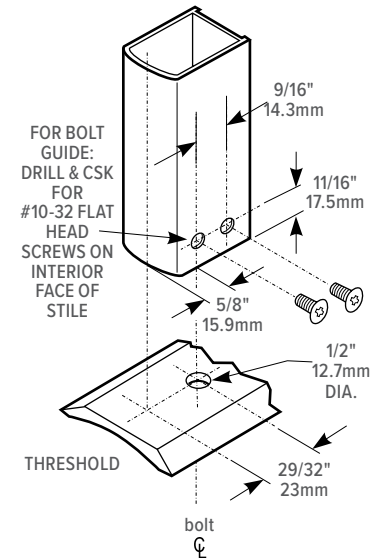
Installation

Install adaptor arm in lock from rear with bolt retracted as shown. Drive pin through slots in lock side plates passing through hole in the adaptor arm.



Stile Preparation

See basic MS® Deadlocks MS1850S, MS1850SN, MS1950, MS1950-050



How to Order, Related & Compatible Products

4015 Threshold Bolt: Specify quantity and the following information. Order related products separately.

MODEL	ADD DASH NUMBER FOR "UNIVERSAL SIZE"	PACKAGING
4015	-18	-1B
		1B Individually Boxed

Please specify cylinder height if ordering in volume for a specific cylinder height.

RELATED

When purchasing this product, please consider the following related products, available separately:

ACCESSORIES
4016 Header Bolt, 4085 Header Bolt

COMPATIBLE

DEADLOCKS	ACCESSORIES
MS1850S, MS1850S-050, MS1850SN, MS1850SN-050, MS1950, MS1950-050 Series Deadlocks	4005 Strike

Experience a safer
and more open world



4085

Header Bolt (Pairs of Doors Only)



4085 Header Bolt provides top-of-door third locking point for pairs of doors when working in conjunction with an MS® pivoted bolt deadlock and 4015 Threshold Bolt in the active leaf.

Function

Designed to add a top-of-door third locking point for pairs of doors when used in conjunction with a pivoted bolt MS® deadlock and 4015 Threshold Bolt in the active leaf. The 4085 Header Bolt is mounted in the inactive leaf. This additional bolt, triggered by the pivoted MS® bolt, expands in a scissor-like action to center itself in its strike as it rises. This action saves the key holder from the difficulty of lining up the doors with three separate strikes, even if doors are misaligned due to faulty installation or settling. The 4085 Header Bolt can be added to any basic MS1850S, MS1850SN, MS1950 Series deadlock with the 4015 Threshold Bolt for a Maximum Security three-point locking solution.

Operation

360° turn of key or thumbturn in basic MS® deadlock throws counterbalanced bolt into opposite door, kicking positioner bolt into header strike. Positioner bolt may be manually thrown before closing active leaf to reduce effort on key-bow. Key can be removed only when bolts are in a positively locked or unlocked position.

Features

Header Bolt

1/2" x 1-1/2" [12.7 mm x 38.1 mm]
expanding bolt with 5/8" [15.9 mm]
throw. Housed in 1-1/2" x 2-3/4" x 5/8"
[38.1 mm x 69.9 mm x 15.9 mm] case.

Adjustment

Minor adjustment of rod length is accomplished by turning nylon rod end.

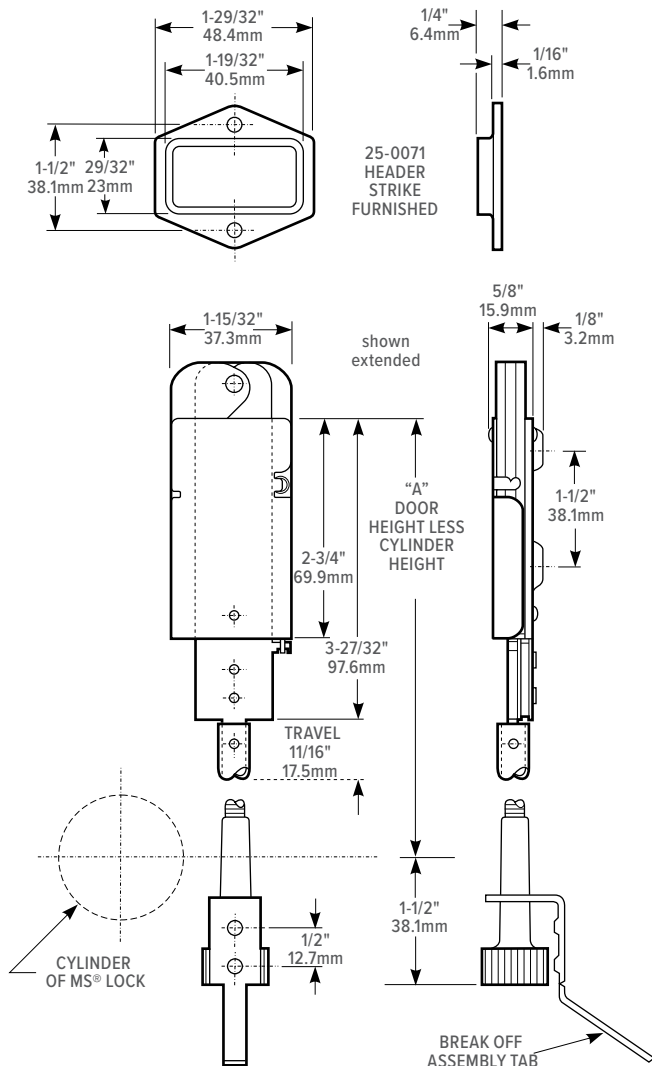
Standard Package

Packed separately with rod guide, screws, and header strike.

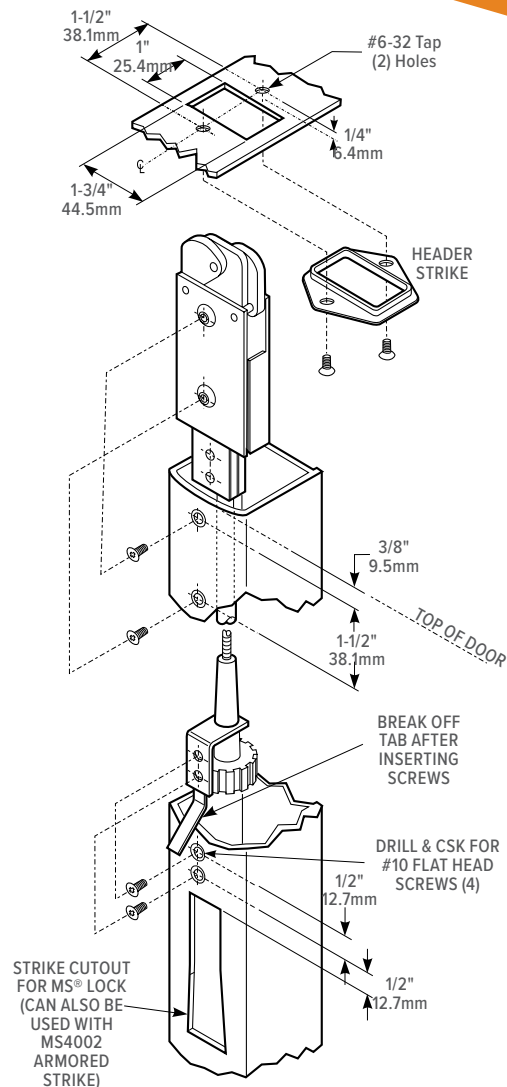
Shipping Weight

1 lb [0.45 kg].

Dimensions



Header Preparation for Strike



How to Order, Related & Compatible Products

4085 Header Bolt (Pairs of Doors Only) Specify quantity and the following information. Order related products separately.

MODEL	DIMENSION 'A'	PACKAGING
4085	-02	-IB
	01 30" - 52"	IB Individually Boxed
	02 52" - 67"	
	03 67" - 79"	
	04 79" - 92"	

Example

DOOR HEIGHT		CYLINDER HEIGHT	=	A
96"	-	40"	=	56"

Reference

7' Door is 84"	9' Door is 108"
8' Door is 96"	10' Door is 120"

RELATED

When purchasing this product, please consider the following related products, available separately:

ACCESSORIES
4015 Threshold Bolt

COMPATIBLE

DEADLOCKS
MS1850S, MS1850S-050, MS1850SN, MS1850SN-050, MS1950, MS1950-050 Series Deadlocks
Not applicable to 7/8" backset locks.

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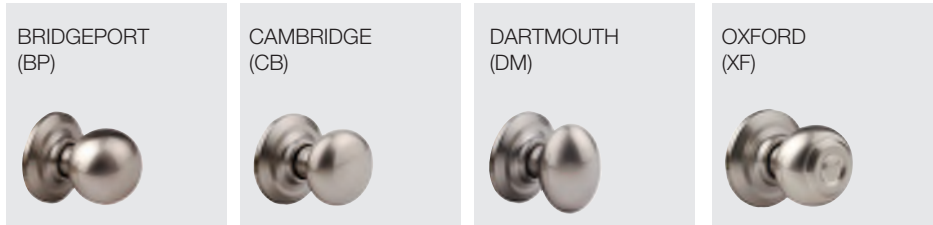


YH Collection™
Grade 2 Residential
Light Commercial



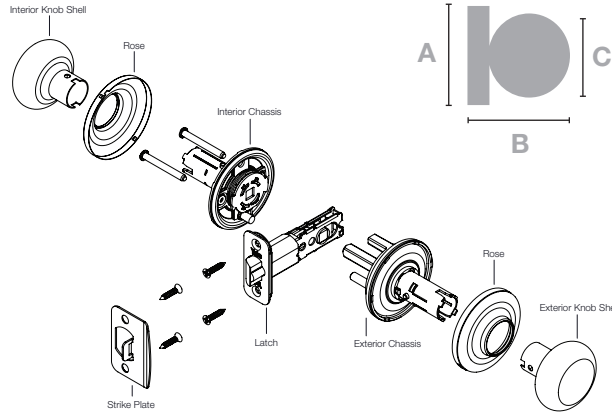
The world's favorite lock since 1840

Knob selection



Knob/Lever Specifications

Door Specs	2 1/8" Face Bore 1" Edge Bore 2 3/8" or 2 3/4" Backset
	Box Pack: Latch Face 1" x 2 1/4" RC (Round Corner) SC (Square Corner, optional)
Latch	Box Pack: Adjustable 2 3/8" to 2 3/4" RC RC (Round Corner)
Door Thickness	1 3/8" to 1 3/4"
Cylinder	6 Pin Cylinder (KW-1 Compatible)
Keying	Box Pack: KA3 (Keyed Alike)
Faceplate	1" W x 2 1/4" H RC (Round Corner)
Strike	Box Pack: 2 1/4" Full Lip RC (Round Corner)
Certified ANSI/BHMA	A156.2 Series 4000 Grade 2



FUNCTIONS

- KNOB**
DUMMY 80
PASSAGE 10
ONE SIDED w/Plate 60
PRIVACY 20
BATH* 26
ENTRY 70
- CLASSROOM** 75
STOREROOM 78
- *Bath: Privacy with US26 interior finish

DIMENSIONS	A	B	C
BRIDGEPORT	2 9/16"	2 9/16"	2"
CAMBRIDGE	2 9/16"	2 1/4"	2 5/64"
DARTMOUTH	2 9/16"	2 3/8"	2 1/2"
OXFORD	2 9/16"	2 1/4"	2 1/8"

QuickShip™	US3	US5	US10BP	US10BE	US15	US15A	US26	US26D	GM	BSP
BRIDGEPORT	•				•					
CAMBRIDGE	•	•	•		•	•	•	•	•	•
DARTMOUTH	•		•		•					
OXFORD	•		•		•					

Does your lock have these features?

PUSH BUTTON LOCKING
panic-free egress

PRE-INSTALLED SCREWS
aligned for ease of installation

FOUR-WOUND SPRING
longer life cycles/
eliminates lever sag

SHROUD
anti-pry
security

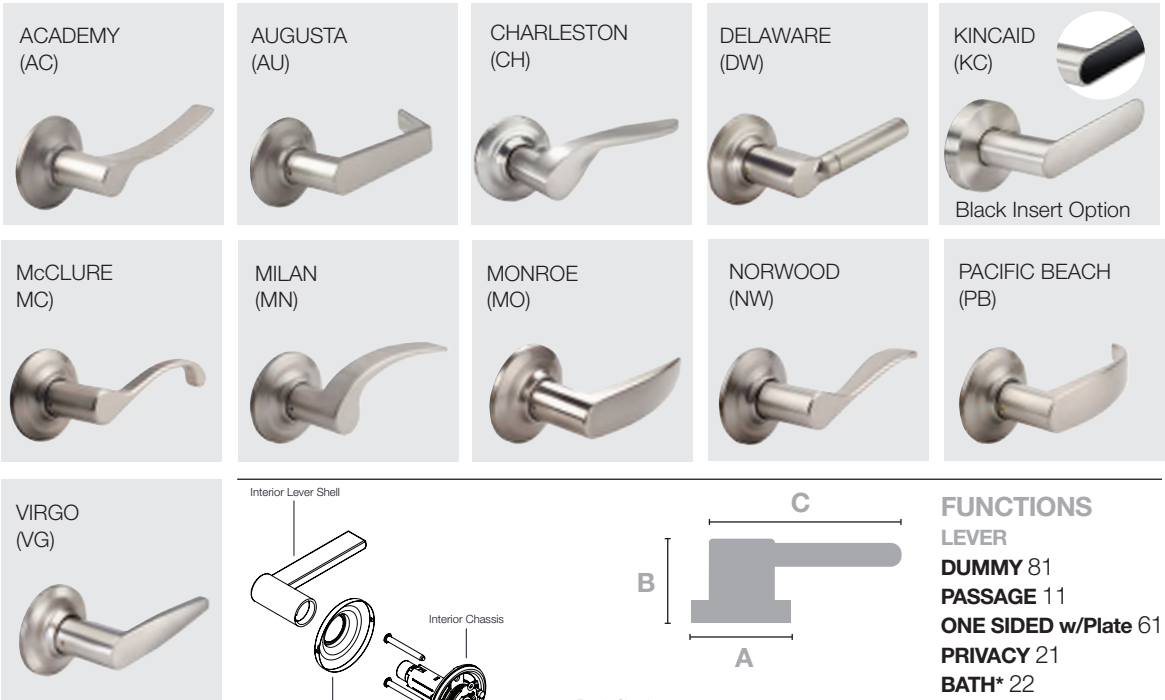
CONCEALED SCREWS
clean design

NON-HANDED LEVERS
eliminate handing issues

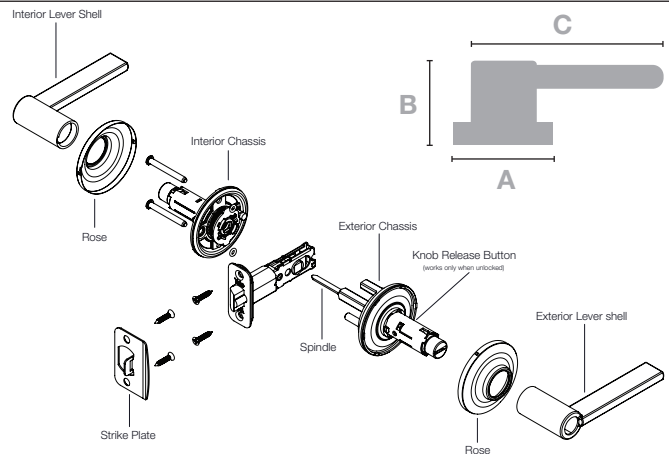
SOLID STEEL SPINDLE
greater durability



Lever selection



DIMENSIONS	A	B	C
ACADEMY	2 9/16"	2 7/16"	4 19/64"
AUGUSTA	2 9/16"	2 1/2"	4 3/4"
CHARLESTON	2 9/16"	2 1/2"	5 3/8"
DELAWARE	2 9/16"	2 3/4"	4 5/8"
KINCAID	2 9/16"	2 7/16"	4 1/2"
MARINA	2 9/16"	3 5/16"	4 7/8"
McCLURE	2 9/16"	2 7/16"	4 3/16"
MILAN	2 9/16"	2 7/16"	4 1/16"
MONROE	2 9/16"	2 7/16"	4 5/8"
NORWOOD	2 9/16"	2 1/2"	4 7/32"
PACIFIC BEACH	2 9/16"	2 7/16"	4 3/4"
VALDOSTA	2 9/16"	2 1/2"	4 5/8"
VIRGO	2 9/16"	2 9/16"	4 1/2"



FUNCTIONS
LEVER
DUMMY 81
PASSAGE 11
ONE SIDED w/Plate 61
PRIVACY 21
BATH* 22
ENTRY Lever/Lever 71
ENTRY T-turn 73
ENTRY SFIC 74LC**
CLASSROOM 76
STOREROOM 79

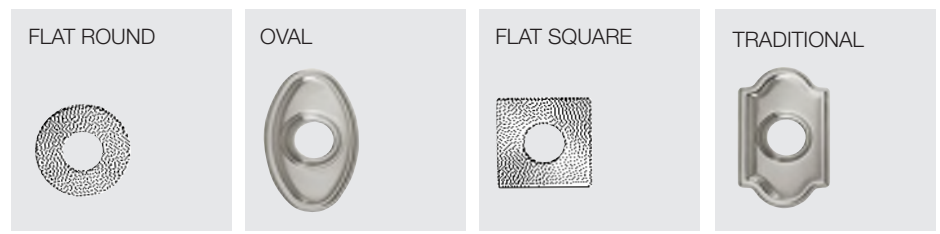
*Bath: Privacy with US26 interior finish
 **Available in Augusta, Monroe, Pacific Beach

QuickShip™	US3	US5	US10BP	US10BE	US15	US15A	US26	US26D	GM	BSP
ACADEMY		•			•					•
AUGUSTA	•		•		•					•
CHARLESTON				•	•					•
DELAWARE										
KINCAID			•		•					
KINCAID/BLK	•		•		•					
MARINA			•		•		•			
McCLURE	•		•		•					
MILAN	•				•		•			
MONROE										•
NORWOOD	•	•	•		•	•	•		•	•
PACIFIC BEACH	•				•					•
VALDOSTA					•		•			•
VIRGO										

- YH Collection™**
 Superior light commercial quality with a lifetime limited finish and mechanical warranty.
- Easy install mounting system and square spindles simplify knob and lever installation
 - Keyway: KW-1; SC-1, PARA optional
 - Non-handed levers eliminate handing issues
 - Solid brass key cylinder and housing
 - Removable levers/knobs and rosettes allow for easy scratch-free installation
 - Premier series deadbolts are face removable for easy access to the deadbolt cylinders to make quick work of rekeying without removing the entire deadbolt
 - Heavy-duty shroud adds a security level of anti-pry robustness

Knob | Lever rosettes

Select an upgrade for any knob or lever styles in Polished Brass, Oil Rubbed Bronze Permanent, Satin Nickel, or Polished Chrome.



MS1850S, MS1850S-X5X

Series MS® Deadlocks



Aluminium

Swinging
DoorSliding
DoorMS1850S-
X5X only

The **MS1850S Series MS® Deadlock** utilizes a laminated stainless steel bolt to provide maximum security for a single leaf narrow stile aluminum door. The **MS1850S-X5X Series MS® Deadlock** utilizes a laminated stainless steel hookbolt to provide maximum security for a sliding narrow stile aluminum door. Both are activated by a pivot mechanism.

Function

A huge bolt of laminated stainless steel, nearly 3" long, activated by an uncomplicated pivot mechanism, has made the basic **MS1850S Series MS® Deadlock** the standard of the narrow stile aluminum door industry. The length of this bolt provides maximum security for a single leaf door, even a very tall and flexible one or an installation where the gap between the door and jamb is greater than it should be.

The **MS1850S-X5X Series MS® Deadlock** answers the security need of sliding narrow stile aluminum doors in commercial, industrial, and institutional buildings. The locking mechanism is identical to the MS1850S Series MS Deadlock, except that the massive laminated bolt is provided in a hook shape to resist the parting motion of sliding door and jamb. The over-center maximum security (MS) locking action assures that forced entry attempts to pry the door in any direction, up, down, or sideways will be defeated.

Special configuration: The **1850S-X2X Series Short Throw Deadlock** utilizes a laminated stainless steel short bolt, activated by a pivot mechanism to secure a single leaf narrow stile aluminum door.

Operation

360° turn of key or thumbturn projects or retracts the counterbalanced bolt. Key can be removed only when bolt is in a positively locked or unlocked position. Lock accepts any standard 1" [25.4 mm] length, 1-5/32" [29.4 mm] diameter mortise cylinder with MS® cam such as the 4036 Mortise Cylinder or thumbturn such as the 4066 Thumbturn, available separately. Lock accepts cylinder from either or both sides.



MS1850S



MS1850S-X5X

Features

Backset

7/8" [22.2 mm], 31/32" [24.6 mm], 1-1/8" [28.6 mm], and 1-1/2" [38.1 mm]. 1850S-X2X not available with 7/8" backset.

Case

Measures 1" x 6" x depth [25.4 mm x 152.4 mm x depth], depth varies by backset (see table on left). Steel with corrosion-resistant plating.

Faceplate

Measures 1" x 6-7/8" [25.4 mm x 174.6 mm].

Strike

See below for dimensions of strike slot which can be cut in metal jamb. Trim plate, box strike, and armored strike are available separately.

Bolt

Eight-ply laminated stainless steel. Center ply has alumina-ceramic core to defeat any hacksaw attack, including rod-type "super" hacksaws.

MS1850S: Standard straight bolt measures 5/8" x 1-3/8" x 2-7/8" [15.9 mm x 34.9 mm x 73.0 mm] with 1-3/8" [34.9 mm] throw.

MS1850S-X5X: Hookbolt measures 5/8" x 1-3/8" [15.9 mm x 34.9 mm] with 13/16" [20.6 mm] throw. Hook shaped bolt repels pry bar attempts to "spread" the door from its jamb or lift it off its track.

1850S-X2X: Short bolt measures 5/8" x 1-3/8" x 2-3/8" [15.9 mm x 34.9 mm x 60.3 mm] with 13/16" [20.6 mm] throw.

Standard Package

Individually boxed with faceplate and mounting screws. Strike plates, cylinders and/or thumbturns available separately.

Shipping Weight

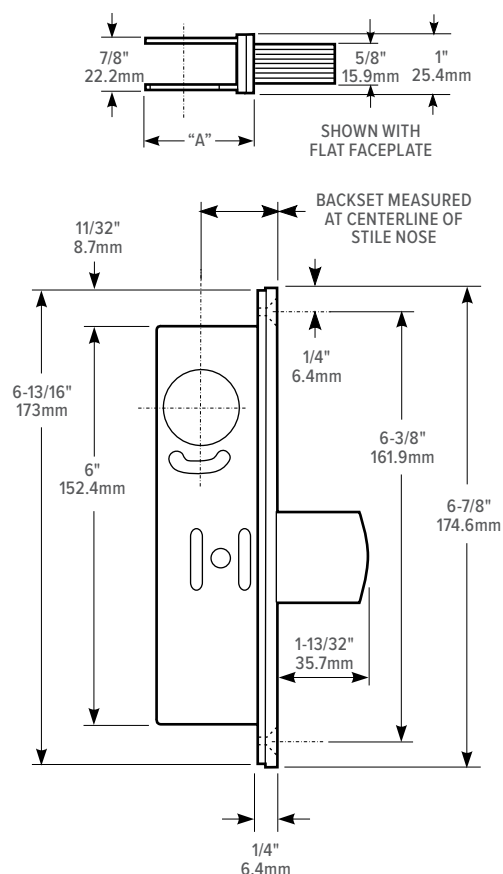
1-1/2 lbs [0.68 kg].

Options

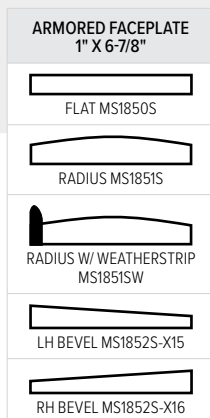
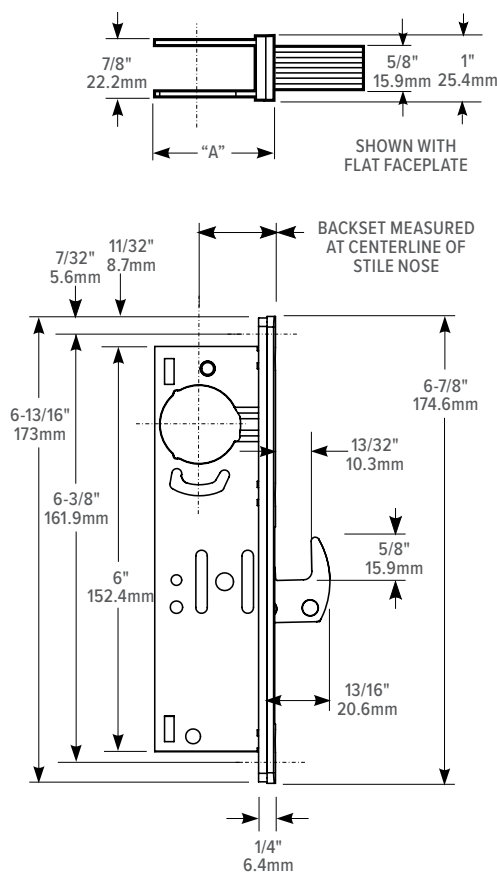
- "SCHOOLHOUSE" version, also available, is modified so that operation from inside is "unlock only". This lock is handed and must be specified LH or RH. Specify SCH1850S or SCH1850S-X5X Series. Same faceplate and backset options as MS1850S and MS1850S-X5X Series.

All measurements are approximate and are provided for informational purposes only. Refer to the product Installation Instructions.

MS1850S Dimensions

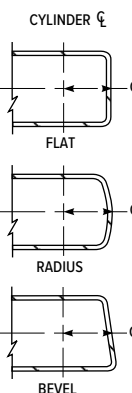


MS1850S-X5X Dimensions



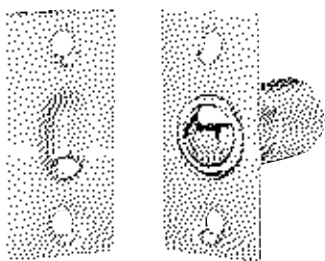
BACKSET	"A"
7/8" 22mm	1-9/16" 34.7mm
31/32" 24.6mm	1-5/8" 41.3mm
1-1/8" 28.6mm	1-25/32" 45.2mm
1-1/2" 38.1mm	2-1/4" 57.2mm

HOW BACKSET IS MEASURED:



Experience a safer
and more open world



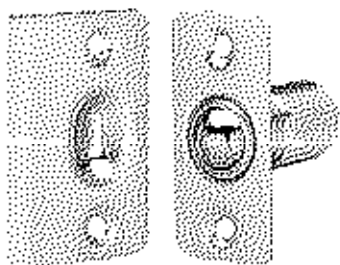


No. 910

Adjustable Ball Catch - Square Corners No. 910, 911

- Material:** Brass
- Finishes:** US3, US26D
- Fastener:** 4 ea. #6 x 3/4" FH SMS
- Other:** No. 910: Narrow strike for mounting on door, catch in jamb
No. 911: Wide strike for mounting on jamb, catch in door
- Features:** Dual adjustment for door clearance and holding strength

No.	Body Size	Strike Size	Weight	ANSI A156.9
910	1" x 2 1/8"	1 1/16" x 2 1/8"	0.2 lbs.	B03017
911	1" x 2 1/8"	1 3/8" x 2 1/8"	0.2 lbs.	B03017



No. 911RC

Adjustable Ball Catch - Round Corners No. 910RC, 911RC

- Material:** Brass
- Finishes:** US3, US26D
- Fastener:** 4 ea. #6 x 3/4" FH SMS
- Other:** No. 910RC: Narrow strike for mounting on door, catch in jamb
No. 911RC: Wide strike for mounting on jamb, catch in door
- Features:**
- 1/4" radius corners for easy mortise installation
 - Dual adjustment for door clearance and holding strength

No.	Body Size	Strike Size	Weight	ANSI A156.9
910RC	1" x 2 1/8"	1 1/16" x 2 1/8"	0.2 lbs.	B03017
911RC	1" x 2 1/8"	1 3/8" x 2 1/8"	0.2 lbs.	B03017

ASSA ABLOY

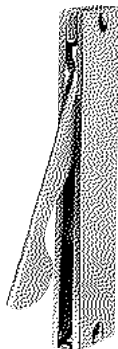
The global leader in
door opening solutions



Cast Lever Edge Pull No. 880

Material: Cast brass
Finishes: US3, US10B, US26D, other finishes available upon request
Fastener: 2 ea. #6x³/₄" FH SMS

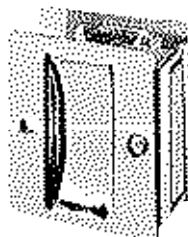
No.	Size	Weight	ANSI A156.14
880	³ / ₄ "x ³ / ₈ "	0.2 lbs.	D2801



Concealed Edge Pull No. 885

Material: Brass
Finishes: Available in standard architectural finishes (see page 9)
Fastener: 2 ea. #6x1" FH WS

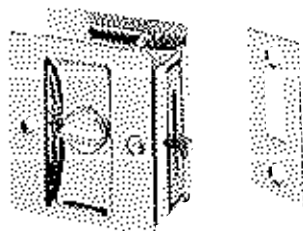
No.	Size	Weight
885	1"x ⁴ / ₄ "	0.5 lbs.



Pocket Door Pull No. 890

Material: Brass
Finishes: US3, US10B, US26, US26D
Fastener: 2 ea. #6x⁵/₈" OH SMS
Other: For use on ¹/₈" and ¹/₄" doors

No.	Size	Weight	ANSI A156.14
890	2 ¹ / ₂ " w x 2 ³ / ₄ " h	0.4 lbs.	D0821



Pocket Door Privacy Latch No. 891

Material: Brass
Finishes: US3, US10B, US26, US26D
Fastener: 4 ea. #6x⁵/₈" OH SMS
Other: For use on ¹/₈" and ¹/₄" doors
Features:

- Turn piece locks to jamb strike
- Emergency release on opposite side

No.	Size	Weight	ANSI A156.14
891	2 ¹ / ₂ " w x 2 ³ / ₄ " h	0.4 lbs.	D0831

ASSA ABLOY

The global leader in
door opening solutions



8800 Series

ANSI/BHMA Grade 1 Certified Mortise Locks





Secure:
Stainless steel reinforced deadbolt

Easy and flexible installation:
Field reversible lever handing and latchbolt

Resistant to abuse:
Heavy-duty trim prevents damage

No visible screws:
Great deterrent to vandalism

Indicator available:
Options to suit any application, see page 20



Hurricane



Features



Features

- Heavy-duty trim for resistance against damage and vandalism
- Functions available for any industrial or commercial application
- Field adjustable lever handing and latchbolt
- ANSI/BHMA Certified Grade 1 for long-life and durability
- UL/cUL listed for 3 hour fire rated doors
- 10 year mechanical warranty
- Available in a variety of attractive trims and finishes
- Status indicator options available to provide peace of mind on the locked/unlocked status of a door



Escutcheon Trim



Rose/Sectional Trim

Applications

- Offices
- Shopping centers
- Industrial buildings
- Commercial facilities

Specifications

Armor Front	8" x 1-1/4"
Backset	2-3/4" only
Case	Wrought steel, zinc dichromated
Deadbolt	1" throw, cast stainless steel.
Door Thickness	1-3/4" standard, available for up to 3-1/4" thick doors
Handing	Field reversible
Hubs	3/8" solid steel, fine-blanked and heat treated for additional strength
Latchbolt	3/4" throw, stainless steel one-piece anti-friction
Strike	1-1/4" (model 2815) curved lip strike standard, see page 41 for additional options.

SL8800

For more heavy-duty applications, the SL8800 Series Mortise Lock offers an extra measure of security. The SL8800 is ideal for situations where heavy abuse or vandalism might be a concern. The SL8800 is available in most mortise lock functions; please see pages 14-19 for more information.

Features

- Heavy duty escutcheon trim that is flat against the door to resist damage and vandalism
- Lever attached directly to escutcheon for added security
- Thrubolted security head screws offer added protection




















Applications

- Schools
- Minimum security prisons
- High crime areas
- SL trim available in 630 finish only.

Finishes



The Yale® 8800 Series Mortise Lock is available in the finishes below. All knobs, lever handles, roses, escutcheons, cylinder collars and other exposed parts are fabricated of either brass, stainless steel or zinc and will be compatible with the finish ordered. When ordering, specify the finish required by the ANSI/BHMA Code Number only. When locksets are ordered with different trim finishes on each side, specify the outside finish first, i.e. AUR8817-2 x 612 x 625. The front and strike finish will match the inside finish unless specified otherwise.

ANSI/BHMA Code Finish Description				
605 Bright Brass, Clear Coated	606 Satin Brass, Clear Coated	609 Satin Brass, Blackened, Satin Relieved, Clear Coated	611 Bright Bronze, Clear Coated	612 Satin Bronze, Clear Coated
				
613E Dark Oxidized Satin Bronze - equivalent	616 Satin Bronze, Blackened, and Satin Relieved, Clear Coated	618 Bright Nickel Plated, Clear Coated	619* Satin Nickel Plated, Clear Coated	620 Satin Nickel Plated, Blackened, Satin Relieved, Clear Coated
				
625 Bright Chrome Plated	626* Satin Chrome Plated	629 Bright Stainless Steel	630* Satin Stainless Steel	693 Black Painted
				
BSP Black Suede Powder Coat	WSP White Suede Powder Coat			
				

Notes:

613 and 722 finishes available by Special Product Application Request only. Please contact customer service for more information.

Designer trims are available in only the following finishes: 605, 606, 619, 625, 656. SL trim only available in 630 finish only. Reflections® decorative levers are NOT available in the following finishes: 609, 616, 620, 693.

*Finish available with MicroShield® antimicrobial coating, additional finishes by special application. Consult factory for availability.

MicroShield coating may vary finish color from architectural standards. MicroShield is not intended as a substitute for traditional infection control programs such as hand hygiene or use of disinfectants. Coated products must still be cleaned to ensure the surfaces will be free of destructive microbes. Yale makes no representations or warranties, express or implied, as to the efficacy of MicroShield.

Indicators



Applications

8800 Series indicators can be used in a variety of applications and are most commonly used to identify occupancy or display the locked/unlocked status of a room.

- Restrooms
- Quiet rooms
- Nursing mother's rooms
- Classroom doors

Features

- Inside, outside or both sides of the door
- Sectional or escutcheon trim
- Available with 24 different functions – including thumbturn functions
- Viewing window 25% larger than competition
- Patented curved design for viewing at multiple angles
- Window located prominently above the cylinder
- Highly reflective viewing window for increased safety
- Optional directional engraving available – must specify handing
- Retrofittable for existing applications



Functions

• Indicators are available with the following 8800 Series functions. See pages 14-19 for details.

8802	8827
8808	8832
8808-2	8840
8809	8847
8811-2	8860
8812-2	8860-2
8814	8861
8814-2	8862
8815	8864
8818-2	8865
8820	8866
8822	8867



Indicators

Sectional Trim

- Surface mounted
- Torx security screws provided
- Compatible with all rose designs: CO, R3, R4, R5, R6, R7, R8
- Available with optional directional arrow engraving

To order indicator with complete lock, specify by adding V series indicator option code to order string. See page 23 for indicator codes and page 24 for how to order examples.



Retrofit/Upgrade Kits

Retrofit/upgrade kits only are available for existing applications only. Each kit includes single side indicator plate with mechanism, screw pack, plastic template and instructions.

To order retrofit/upgrade kits only, specify by model number below. Door thickness, handing and indicator option code must also be specified with kit. Retrofit/upgrade kits with directional engraving must include lock handing.

See page 24 for how to order examples. Note: Indicators for both sides of door require two kits.

	Model #	Used with Functions	Available Option Codes	Indicator Location
	YA190	8811-2, 8814, 8814-2, 8815, 8818-2, 8822, 8832, 8840, 8847, 8860, 8860-2, 8861, 8867	Outside Trim: V10, V20, V30, V40, V50, V60 Inside Trim: V01, V03, V04, V06	Inside and/or Outside*
	YA191	8812-2		
	YA192	8808, 8808-2, 8809		
	YA193	8802, 8820, 8827, 8862, 8864	V10, V20, V30, V40, V50, V60	Outside
	YA194	8802, 8820, 8822, 8827, 8832, 8840, 8847, 8860, 8861, 8867	V01, V03, V04, V06	Inside
	YA196	8862, 8864, 8865, 8866		
	YA198	8809		
	YA197	8866	Outside Trim: V10, V20, V30, V40, V50, V60 Inside Trim: V01, V03, V04, V06	Inside, Outside

*When indicators are required on both sides of the door, 2 upgrade kits must be ordered, one kit for each side.

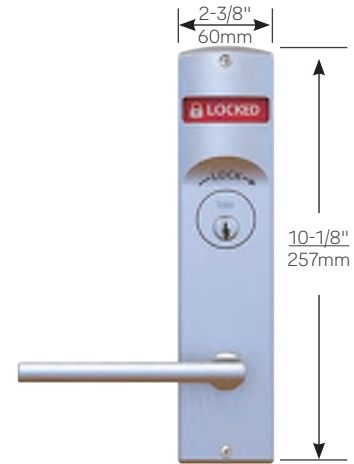
Indicators



Escutcheon Trim

- Unique escutcheon (VN) for both inside and outside of door for indicator functions
- Non-indicator functions provide with standard escutcheons as ordered, i.e. E3, E4, CN, SL
- Through-bolted
- Torx security screws optional
- Available with optional directional arrow engraving

Specify option code when ordered with lock. See page 23 for indicator option codes and page 24 for how to order examples.



Escutcheon Trim Upgrade Kit Only

Complete trim kits are available to retrofit/upgrade existing applications.

Trim kit includes levers and escutcheons with mechanism for both sides of door, screw pack, door marker and instructions.

To order trim kit only, specify by adding TP prefix to function required with trim, hand, finish and indicator option code.

Prefix	Functions
TP	All functions*

*Escutcheon indicator trim kits available for all functions as listed on page 20 except 8814, 8814-2, 8815.

Note: Escutcheon applications require both sides of the door to have the unique VN escutcheon. Kits will be provided as a set.

How to Order Example (Escutcheon Kit Only)

Lever	Escutcheon	Function	Hand	Finish	Options
AU	VN	TP8802*	RH	626	V21 x EMB

* The function of the existing lock is required so the proper escutcheons can be provided.

Privacy Bedroom/Bath function x escutcheon trim x double indicator - Vacant/Occupied – Green/Red (Outside) Unlocked/Locked – Green/Red (Inside) x inside engraving with "Lock" and directional arrow

Indicators



Indicator Option Codes

8800 Series indicator option codes are designed to convey wording, color and side of door desired in one simple code. To order, specify option code for complete locksets and/or retrofit/upgrade trim kits.



Single Indicator			
Option Code	Outside Wording	Inside Wording	Color
V10	Unlocked/Locked	No Indicator	Green/Red
V10F	Ouvert/Fermé	No Indicator	Green/Red
V20	Vacant/Occupied	No Indicator	Green/Red
V20F	Libre/Occupée	No Indicator	Green/Red
V30	Icons Only	No Indicator	Green/Red
V40	Unlocked/Locked	No Indicator	White/Red
V50	Vacant/Occupied	No Indicator	White/Red
V60	Icons Only	No Indicator	White/Red
V01	No Indicator	Unlocked/Locked	Green/Red
V01F	No Indicator	Ouvert/Fermé	Green/Red
V03	No Indicator	Icons Only	Green/Red
V04	No Indicator	Unlocked/Locked	White/Red
V06	No Indicator	Icons Only	White/Red
Double Indicator			
Option Code	Outside Wording	Inside Wording	Color
V11	Unlocked/Locked	Unlocked/Locked	Green/Red
V11F	Ouvert/Fermé	Ouvert/Fermé	Green/Red
V21	Vacant/Occupied	Unlocked/Locked	Green/Red
V21F	Libre/Occupée	Ouvert/Fermé	Green/Red
V33	Icons Only	Icons Only	Green/Red
V44	Unlocked/Locked	Unlocked/Locked	White/Red
V54	Vacant/Occupied	Unlocked/Locked	White/Red
V66	Icons Only	Icons Only	White/Red
Engraving			
Option Code	Outside	Inside	Wording
EMA	Engraving	No Engraving	"Lock" with arrow
EMB	No Engraving	Engraving	"Lock" with arrow
EMC	Engraving	Engraving	"Lock" with arrow



Engraving Options

- Laser engraving with "LOCK" and directional arrow
- Only available in the following finishes: 605, 606, 618, 619, 625, 626, 629*, 630*
- Available with MicroShield®
- Door handing must be specified

Option Code	Description
EMA	Engraving located on outside of door
EMB	Engraving located on inside of door
EMC	Engraving located on inside and outside of door

Note: Engraving is available as an option for all functions when ordered with an indicator. Option codes must be specified with complete lock and/or retrofit (upgrade) kits/trim.

*Indicator escutcheon is nickel plated to match Stainless Steel



How to Order Examples

Complete with Lock

Sectional Trim

Trim	Function	Hand	Finish	Options
AUR	8818-2FL	RH	626	V01

Classroom Security Intruder Latchbolt function x sectional trim x single indicator inside – Unlocked/Locked – Green/Red

Escutcheon Trim

Lever	Escutcheon	Function	Hand	Finish	Options
AU	VN	8802FL	RH	626	V21 x EMB

Privacy Bedroom/Bath function x escutcheon trim x double indicator - Vacant/Occupied – Green/Red (Outside) Unlocked/Locked – Green/Red (Inside) x inside engraving with "Lock" and directional arrow

Retrofit (Upgrade)/Trim Kit Only

Sectional Trim*

Model #	Door Thickness	Hand	Finish	Option
YA190	1-3/4"	RH	626	V04

Keyed function indicator for sectional trim x single indicator inside – Unlocked/Locked – Red/White

* When indicators are required on both sides of the door, 2 upgrade kits must be ordered, one kit for each side.

Escutcheon Trim

Lever	Escutcheon	Function	Hand	Finish	Options
AU	VN	TP8802**	RH	626	V21 x EMB

Privacy Bedroom/Bath function x escutcheon trim x double indicator - Vacant/Occupied – Green/Red (Outside) Unlocked/Locked – Green/Red (Inside) x inside engraving with "Lock" and directional arrow

** The function of the existing lock is required so the proper escutcheons can be provided.



Indicators - IND/CIND Option

Indicator options IND and CIND are provided with a padlock icon on a green or red background.

Trim Availability

	IND	CIND
Levers/Knobs	All	All
Roses	CO, R3, R4, R5, R6, R7, R8	CO, R6, R7, R8
Escutcheons	CN	CN



Functions

Indicators are available on the outside of the door for the following functions:

	8802	8818-2*	8820	8822	8827	8832	8862	8864
IND	Optional						Optional	
CIND		Optional	Standard	Optional	Standard	Optional		Standard

*Specify mounting side.

How To Order

When ordering with lock, specify the complete lock ordering string and include option code based on function.

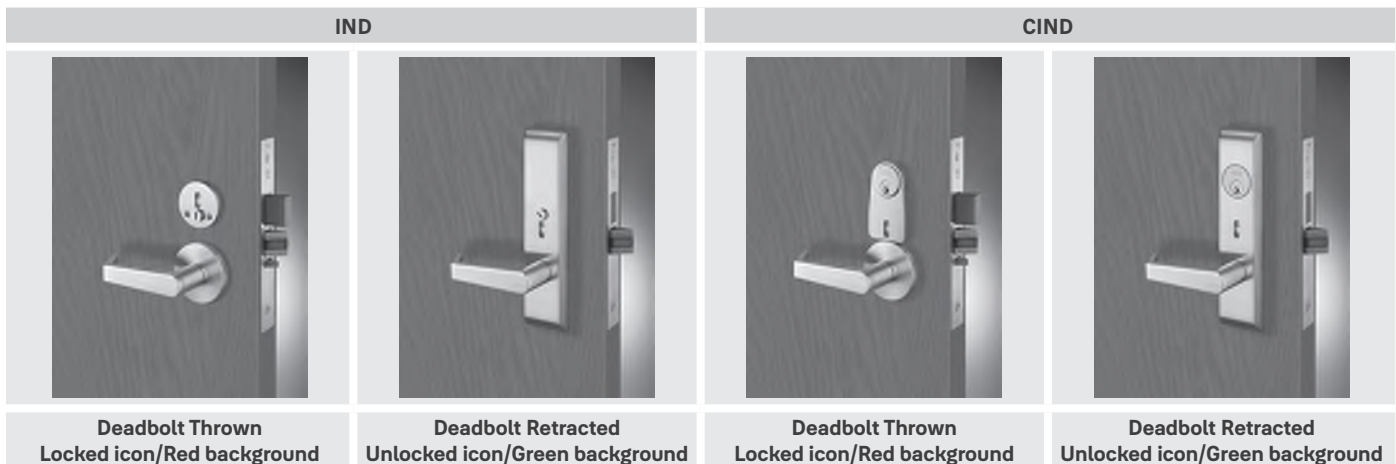
Trim	Function	Hand	Finish	Option
AUR	8802FL	RH	626	IND
AUCN	8822FL	RH	626	CIND

When ordering for upgrade to existing lockset, specify kit number x finish.

Trim	Type	Kit
Sectional	Privacy	IND-K x Finish
Sectional	Cylinder	CIND-K x Finish
Escutcheon	Privacy	CN88 x 261 x Finish
Escutcheon	Cylinder	CN88 x 260 x Finish
Escutcheon	Cylinder w/cointurn	CN88 x 262 x Finish

Notes:

- IND-K and CIND-K are kits which includes indicator mechanism and mounting hardware. Cylinder not included.
- For escutcheon trim, CN88 is the outside escutcheon only with indicator assembly, does not include levers or cylinder

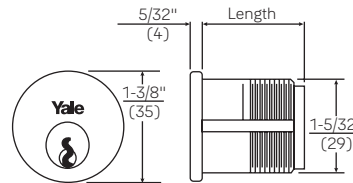




Conventional Mortise Cylinders

Illustration	Cylinder Model Number	Application	Cam	Length	
				6-Pin	7-Pin
	2153	Standard cylinder	2160	1-1/8" 1-1/4" 1-3/8" 1-1/2" 1-5/8" 1-3/4"	1-1/4" 1-3/8" 1-1/2" 1-5/8" 1-3/4"
	2153S	For inside operation of 8817-2 and 8834-2 functions only	2130		
	2123	Cylinder for longer lengths	2160	1-7/8" thru 3-1/2" in 1/8" increments*	
	2123S	For inside operation of 8817-2 and 8834-2 functions only for longer lengths	2130		
	2719	For 8820, 8827, 8831 and 8832 functions	2160	1-3/8"	—

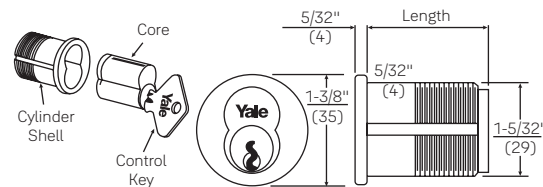
*Contact Technical Product Support for cylinder collar requirements when ordering these cylinders separately. See pages 33-40 for other collar requirements.



Interchangeable Core Mortise Cylinders

Cylinder Model Number	Application	Cam	Length	Pins	Housing Only Model Number	Core Only Model Number
2196	Standard Cylinder	2160	1-1/2", 1-3/4", 2"	6	2221	1210
2197	Standard Cylinder	2160	1-11/16", 2"	7	2213	1220
2196H	For Hotel/Motel Locks 8820, 8827, 8832	2160	1-11/16"	6	2213	1210H
2196S	For inside operations of 8817-2 and 8834-2 functions	2130	1-1/2"	6	2214S	1210
2197S	For inside operations of 8817-2 and 8834-2 functions	2130	1-11/16"	7	2217S	1220

Note: When ordering interchangeable core cylinders or cores only, control keys are not furnished. If control keys are required they must be ordered separately.



Cylinders

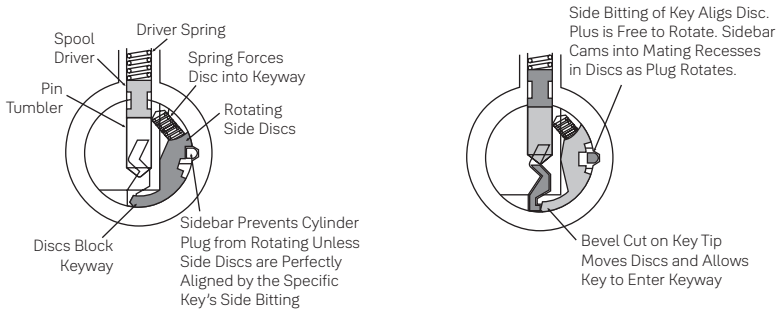


Security Cylinders

Security cylinders contain two independent locking mechanisms. The first is a traditional 6- or 7-pin tumbler mechanism with spool drivers for greatly increased picking resistance.

The second is an innovative 5-tumbler rotating disc mechanism with sidebar engagement. The rotating discs are spring loaded and block the bottom of the keyway.

Illustration



Security/High Security Mortise Cylinders

Model Number	Application	Cam	Length	
			6-pin	7-pin
5153/U5153	Standard Cylinder	2160	1-1/8"	1-1/4"
5153S/U5153S	For inside operations of 8817-2 and 8834-2 functions	2130	1-1/4"	
5719/U5719	For 8820, 8827, 8831 and 8832 functions	2160	1-3/8"	

Security Interchangeable Core Mortise Cylinders

Cylinder Model Number	Application	Cam	Length	Pins	Housing Only Model Number	Core Only Model Number
5196	Standard Cylinder	2160	1-1/2"	6	2221	5210
5197	Standard Cylinder	2160	1-11/16"	7	2213	5220
5196H	For Hotel/Motel Locks 8820, 8827, 8832	2160	1-11/16"	6	2213	5210H
5196S	For inside operations of 8817-2 and 8834-2 functions	2130	1-1/2"	6	2214S	5210
5197S	For inside operations of 8817-2 and 8834-2 functions	2130	1-11/16"	7	2217S	5220

Note: When ordering interchangeable core cylinders or cores only, control keys are not furnished. If control keys are required they must be ordered separately.



Yale® KeyMark®

For those applications requiring protected key control, Yale® KeyMark® cylinders guard against unauthorized key duplication. The Yale KeyMark Security Leg® keyway feature increases resistance against picking and impressioning and can easily retrofit into existing systems. For further details and availability, refer to the separate Yale KeyMark catalog.

Protected Keyway Mortise Cylinders

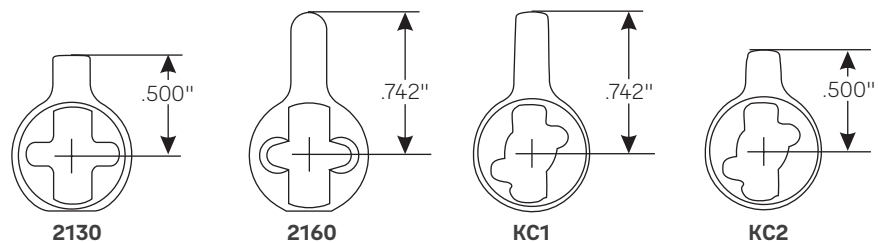
Model Number	Type	Cam	Length	Pins	Housing Only Model Number	Core Only Model Number
K100	Fixed Core Mortise	KC1	1-1/8", 1-1/4" 1-1/2", 1-3/4" 2"	6 or 7	N/A	N/A
K820	Large Format IC Mortise	KC1	1-1/2", 1-3/4" 2"	6	K860	K800
			1-11/16" 2"	7		
K620	Small Format IC Mortise	KC1	1-1/4"	6	K660	K600
			1-3/8", 1-3/4"	6 or 7		
K630	Small Format IC Mortise-Tapered	KC1	1-1/4"	6	K670	K600
			1-3/8"	6 or 7		

Note: KC2 cam required for inside operation of 8817-2 and 8834-2 functions.

Miscellaneous Cylinder

Cams

Model Number	Application	Cam	Length
S2053S	Thumbturn cylinder, for inside operation of 8834 function only	2130	1" 1-1/8"
S2053	Thumbturn cylinder, for replacement of key operated cylinder.	2160	1" 1-1/8"



Other Manufacturers' Keyway Cylinders/Cores

Illustration	Model Number	Type	Cam	Length	Pins	Housing Only Model Number	Core Only Model Number
	A620	Small Format IC Mortise, includes Best® Keyway Core. Available keyed random, master keyed or uncombined. Specify keyway A, B, C, D, E, F, G, H, J, K, L or M.	KC1	1-1/4" 1-3/8" 1-3/4"	6 6 or 7	K660	A600
	2553	Fixed Core Mortise Schlage® "C" Keyway Cylinder. Available 0-bitted or keyed random. Available finishes: 606, 612, 613, 626	2160	1-1/8"	6	N/A	N/A



Strikes

Yale® 8800 Series Mortise Locks come standard with a 2815 Curved Lip Strike with a 1-1/4" (32mm) lip length. The strike supplied will accommodate the locking function, i.e. latchbolt and/or deadbolt, and can be installed on doors 1-3/4" (44mm) thick. These strikes are non-handed.

Material: Brass, Stainless Steel.

Longer/Shorter Lip Lengths: Mortise lock strikes are mounted 3/8" above the center line of the lock. To determine the proper length of lip use the following formula:

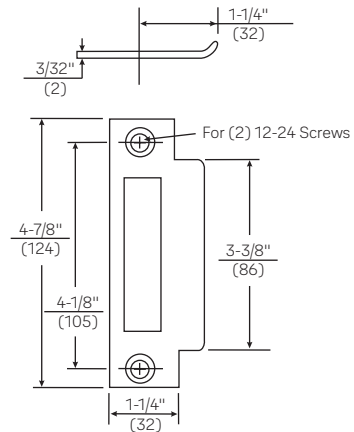
1/2 of the door thickness, plus 1/16" inset, plus trim thickness, plus 1/8" for flat lip strike OR 1/4" for curved lip strike. Select the nearest available length.

2815 Curved Lip:

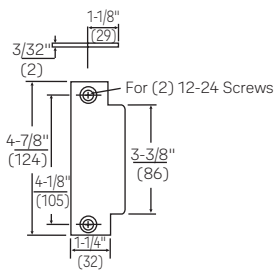
- 1-1/4" (32mm) standard
- To special order
 - 1-1/8" (29mm)
 - 1-3/8" (35mm)
 - 1-1/2" (38mm)
 - 1-5/8" (41mm)
 - 1-3/4" (44mm)
 - 1-7/8" (48mm)
 - 2" (51mm)
 - 2-1/8" (54mm)
 - 2-1/4" (57mm)

2816 Flat Lip:

- To special order,
 - 7/8" (22mm)
 - 1" (25mm)
 - 1-1/8" (29mm)
 - 1-1/4" (32mm)
 - 1-1/2" (38mm)
 - 1-3/4" (44mm)
 - 2" (51mm)
 - 2-1/4" (57mm)
 - 2-1/2" (64mm)



Optional Strikes

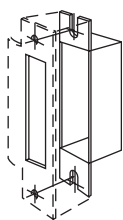


497B ANSI Blank Filler Plate: Reversible to replace a strike where a lock has been removed or where a frame with a strike preparation when no lock is installed on a door. Lip Lengths: 1-1/8" (29mm) only.

Material: Brass, Bronze, Stainless Steel.

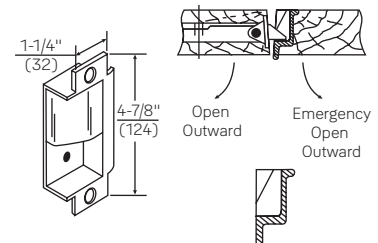
718 Open Back Strike: Field handable for a standard V-beveled pair of doors with a latchbolt only function on the active door. This strike permits emergency opening of the inactive door without damaging the lock mechanism. Available for doors 1-3/4" or 2-1/4" thick only. Specify the door thickness required.

Material: Stainless Steel, Black Nylon Coated.



202 Strike Box: Reversible for installation with all Flat or Curved Lip Strikes. Available to special order only.

Material: Wrought Steel, Zinc Plated, Dichromated.

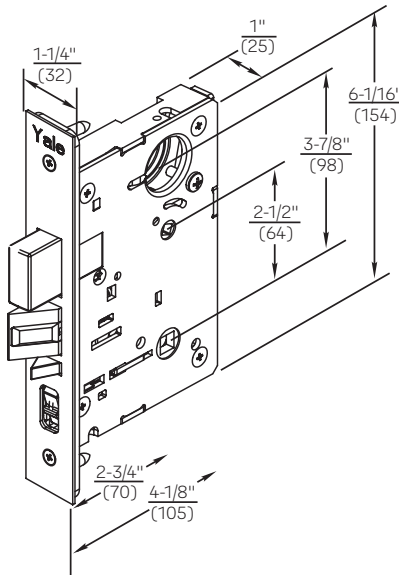


Dimensions and Exploded Views

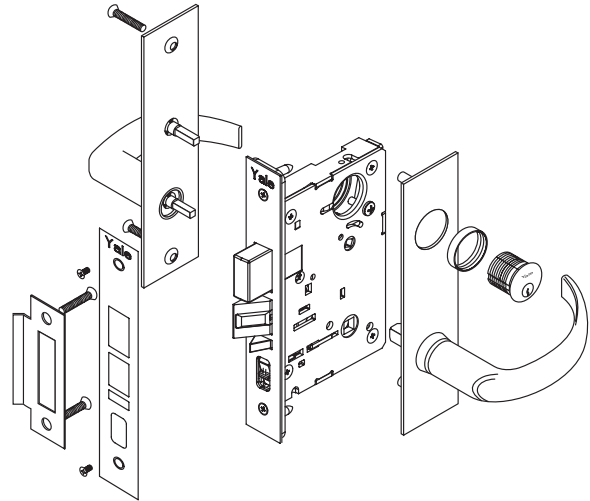


8800/SL8800 Series

- **Armor Front** - 8" x 1-1/4"
- **Door Thickness** - 1-3/4" standard, to 3-1/4" thick doors to order.
- **Deadbolt** - 1" throw, solid investment cast stainless steel.
- **Latchbolt** - 3/4" throw, stainless steel one-piece anti-friction.
- **Backset** - 2-3/4" only.
- **Case** - wrought steel, zinc dichromated.
- **Hubs** - 3/8" solid steel, fine-blanked and heat treated for additional strength.

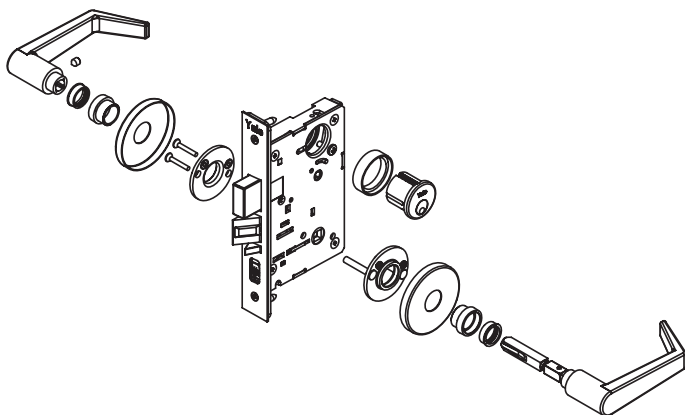


SL8800 Lever

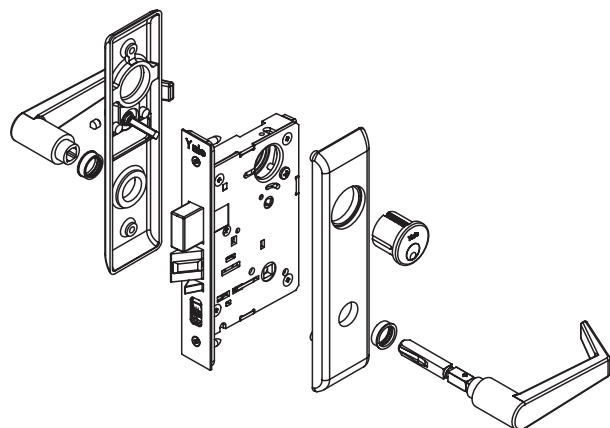


Standard Lever

Sectional



Escutcheon



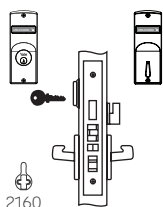


8847 Apartment Corridor Door Lock (F20)

- Latchbolt retracted by knob/lever either side, except when outside knob/lever is locked by stopwork activator
- Deadbolt operated by key outside, thumbturn inside
- When outside knob/lever is locked, latchbolt and deadbolt are operated by key outside
- When deadbolt is projected, outside knob/lever is automatically locked
- Anti-panic operation. Operating inside knob/lever automatically retracts latchbolt and deadbolt with outside knob/lever remaining locked.
- Deadlocking latchbolt

Note: Indicator shows deadbolt position only

Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8847K	8847FL	3/4"	1"
SL	—	SL8847FL	3/4"	1"
Reflections*	—	8847RL	3/4"	1"

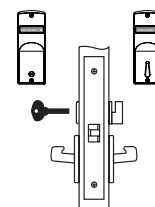


2160

8862 Privacy, Bedroom Or Bath Lock (F22)

- Latchbolt retracted by knob/lever either side except when outside knob/lever is locked by thumbturn
- Operating inside knob/lever retracts the latchbolt, automatically unlocking outside knob/lever
- Outside emergency release unlocks outside knob/lever. E203 emergency key supplied
- Automatically unlocks when door latches

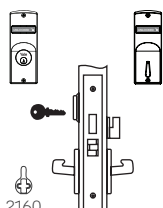
Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8862K	8862FL	3/4"
SL	—	SL8862FL	3/4"
Reflections*	—	8862RL	3/4"



8860 Room Door Lock (F21)

- Latchbolt retracted by knob/lever either side
- Deadbolt operated by key outside, thumbturn inside

Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8860K	8860FL	3/4"	1"
SL	—	SL8860FL	3/4"	1"
Reflections*	—	8860RL	3/4"	1"

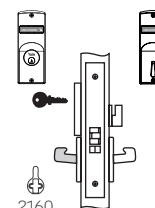


2160

8864 Bathroom Lock With Indicator

- Latchbolt retracted by key outside, knob/lever inside
 - Indicator operated by thumbturn inside, key outside
 - When indicator shows red with a locked padlock icon, key outside will operate indicator and retract latchbolt
 - Outside knob/lever rigid at all times
 - Inside knob/lever always active
 - Deadlocking latchbolt
 - Function only available with C0, R6, R7, R8 roses or CN escutcheon
- Note: CIND indicator provided standard. V series indicators must be specified by option code.

Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8864K	8864FL	3/4"
Reflections*	—	8864RL	3/4"

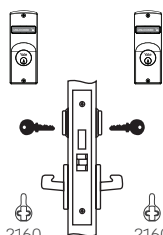


2160

8860-2 Store Door Lock (F14)

- Latchbolt retracted by knob/lever either side
- Deadbolt operated by key both sides

Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8860-2K	8860-2FL	3/4"	1"
SL	—	SL8860-2FL	3/4"	1"
Reflections*	—	8860-2RL	3/4"	1"



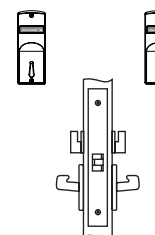
2160

2160

8865 Bathroom Lock

- Latchbolt retracted by knob/lever either side except when outside knob/lever is locked by thumbturn either side
- Outside thumbturn unlocks outside knob/lever
- Automatically unlocks when door latches
- Operating inside knob/lever retracts the latchbolt, automatically unlocking outside knob/lever

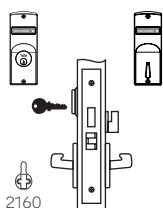
Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8865K	8865FL	3/4"
SL	—	SL8865FL	3/4"
Reflections*	—	8865RL	3/4"



8861 Dormitory Or Storeroom Lock

- Latchbolt retracted by knob/lever either side
- Deadbolt operated by key outside, thumbturn inside
- When deadbolt is projected, outside knob/lever is automatically locked
- When deadbolt is retracted, outside knob/lever is automatically unlocked

Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8861K	8861FL	3/4"	1"
SL	—	SL8861FL	3/4"	1"
Reflections*	—	8861RL	3/4"	1"

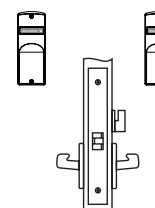


2160

8866 Passage Lock With Indicator

- For doors with indicator that do not require locking
 - Latchbolt retracted by knob/lever either side at all times
 - Throwing thumbturn on inside changes state of status indicator
 - Rotating either knob/lever returns indicator to previous state
- Note: Only available with "V" series indicators. Indicator option code must be specified with this function

Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8866K	8866FL	3/4"
Reflections*	—	8866RL	3/4"



Indicator options available for both sectional and escutcheon trim.

Cylinder cam required.

Indicates rigid knob/lever.

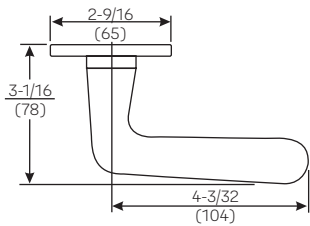
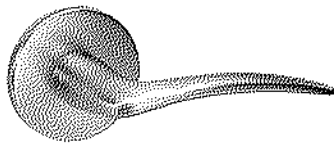


Lever Trim

Standard Rose

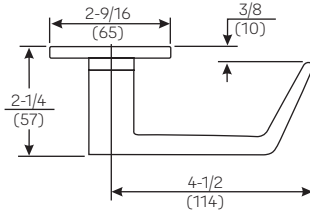
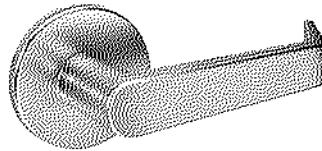
Arcadia - ARR

AR Lever Handle*: Cast
 CO Rose**: Stamped
 Cylinder Collar: See pages 33-40



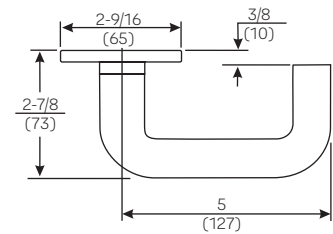
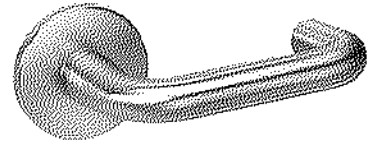
Augusta - AUR

AU Lever Handle: Cast
 CO Rose**: Stamped
 Cylinder Collar: See pages 33-40



Carmel - CRR

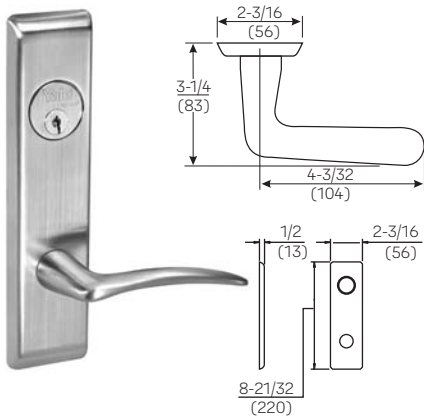
CR Lever Handle: Cast
 CO Rose**: Stamped
 Cylinder Collar: See pages 33-40



Standard Escutcheon

Arcadia - AR X CN

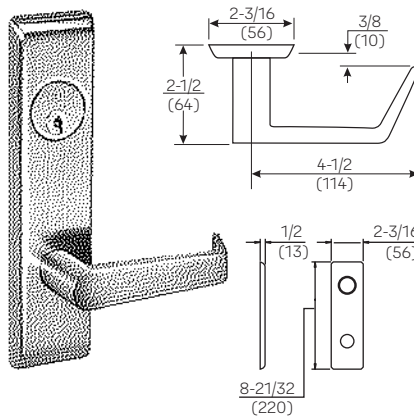
AR Lever Handle*: Cast
 CN Escutcheon**: Cast
 Cylinder Collar: See pages 33-40



Trim also available for SL Series, specify ARSL.

Augusta - AU X CN

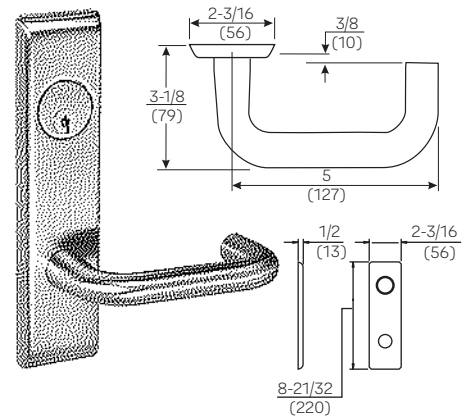
AU Lever Handle: Cast
 CN Escutcheon**: Cast
 Cylinder Collar: See pages 33-40



Trim also available for SL Series, specify AUSL.

Carmel - CR X CN

CR Lever Handle: Cast
 CN Escutcheon**: Cast
 Cylinder Collar: See pages 33-40



Trim also available for SL Series, specify CRSL.

*Indicates levers that are handed.

**Available with Reflections® rose or escutcheon. See page 12 for options.



5400LN Series

Grade 1 Cylindrical Lever Locks





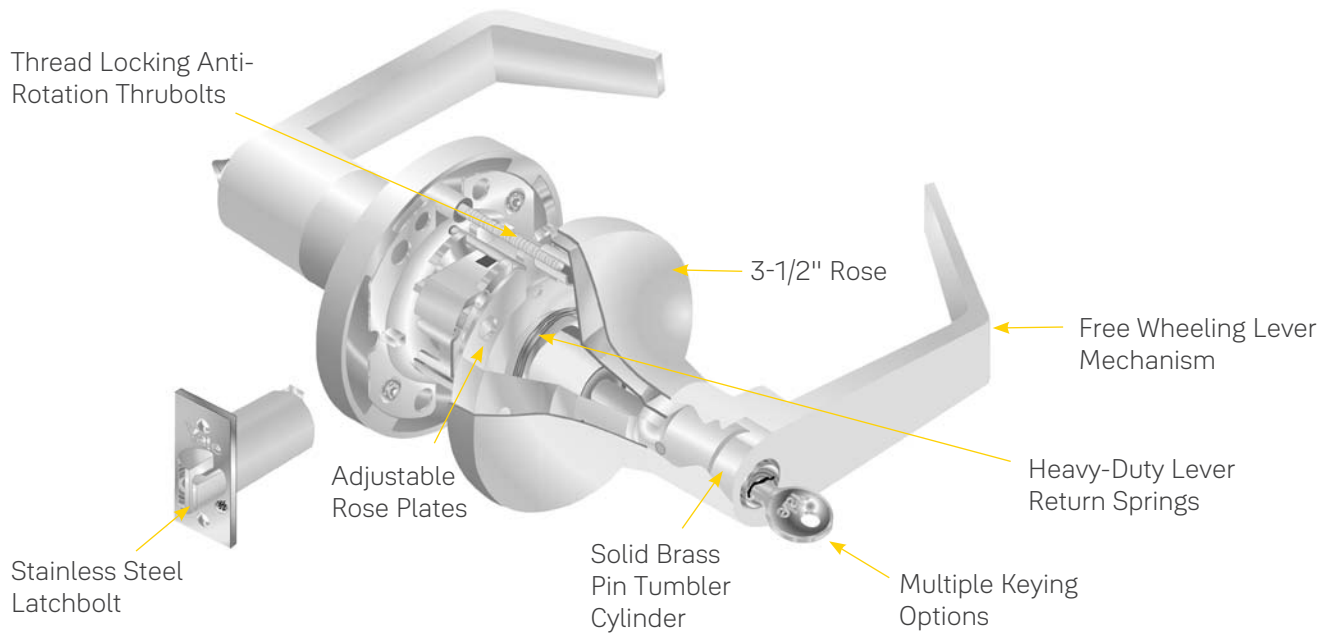
Benefits & Features

Benefits

- **Heavy-Duty:** Rugged Grade 1 construction offers greater reliability and resists wear-and-tear
- **Secure:** Innovative features protect against damage and vandalism
- **Versatile:** Range of functions and options offer an ideal solution for a variety of commercial applications
- **Easy installation:** Adjustable rose allows for easy adjustment on different door thicknesses
- **Strong & Reliable:** ANSI/BHMA Grade 1 certification for long-life and durability

Features

- Heavy duty construction features wear-resistant chassis plates, longer thread-locking thrubolts, lifetime warranted lever return springs and stainless steel latchbolt for exceptional strength and durability
- Free Wheeling lever mechanism prevents vandalism and reduces maintenance
- Adjustable rose support plates
- Available in 3 lever designs, 24 functions (including electrified) and 12 standard finishes
- ANSI/BHMA Certified Grade 1
- ADA compliant for ease of accessibility



Specifications

Backset	2-3/4" standard, 3-3/4" optional
Door Thickness	Adjustable for doors 1-3/4" to 2"
Handing	Non-handed, field reversible
Latchbolt	2-3/4" backset, 1/2" throw. See page 14 for additional options.
Strike	ANSI strike 4-7/8" x 1-1/4" x 1-1/4" lip to center. See page 15 for additional options.
ANSI/BHMA	Certified Grade 1, ANSI/BHMA A156.2
UL/cUL	Listed for 3 hour fire doors
Windstorm	Certified, check local codes.
Warranty	7 years



Finishes



ANSI/BHMA Code Finish Description				
605 Bright Brass, Clear Coated	606 Satin Brass, Clear Coated	609 Satin Brass, Blackened, Satin Relieved, Clear Coated	612 Satin Bronze, Clear Coated	613E Dark Oxidized Satin Bronze - equivalent
616 Satin Bronze, Blackened, and Satin Relieved, Clear Coated	619* Satin Nickel Plated, Clear Coated	620 Satin Nickel Plated, Blackened, Satin Relieved, Clear Coated	625 Bright Chrome Plated	626* Satin Chrome Plated
693 Black Painted	BSP Black Suede Powder Coat	WSP White Suede Powder Coat		

613 and 722 finishes available by Special Product Request only. Please contact Customer Service for additional information.

*Finish available with MicroShield® antimicrobial coating, additional finishes by special application. Consult factory for availability.

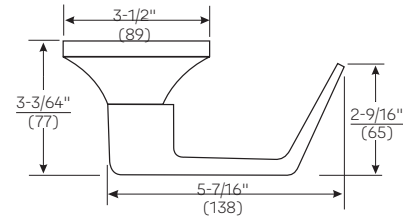
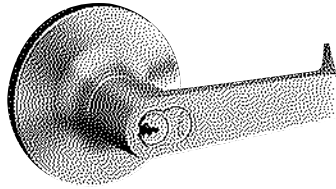
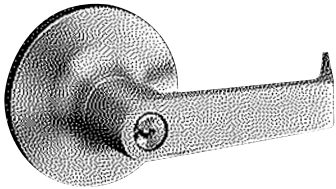
MicroShield coating may vary finish color from architectural standards. MicroShield is not intended as a substitute for traditional infection control programs such as hand hygiene or use of disinfectants. Coated products must still be cleaned to ensure the surfaces will be free of destructive microbes. Yale makes no representations or warranties, express or implied, as to the efficacy of MicroShield.

Lever Trim



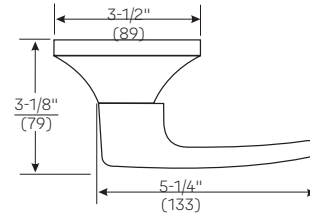
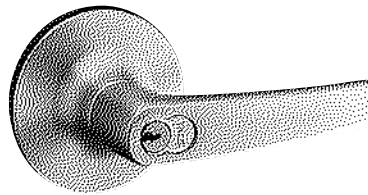
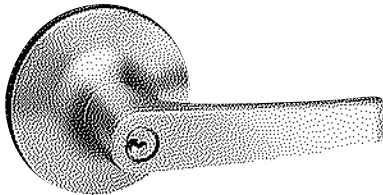
Augusta AU

Lever: Cast Zinc
Rose: Wrought Brass



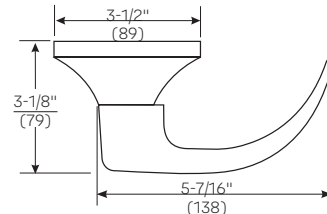
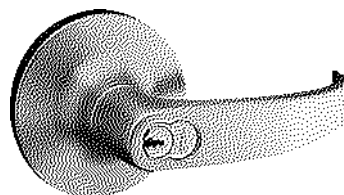
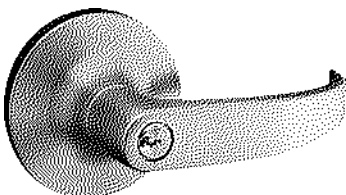
Monroe MO

Lever: Cast Zinc
Rose: Wrought Brass



Pacific Beach PB

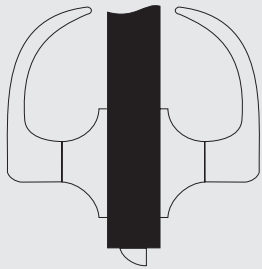
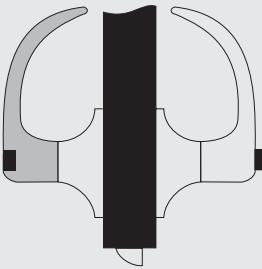
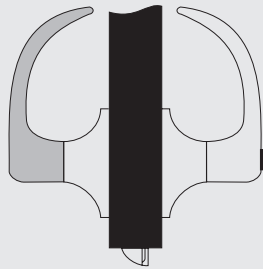
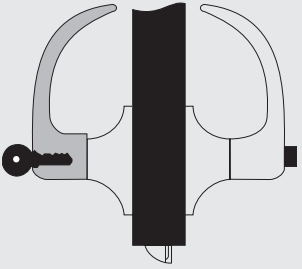
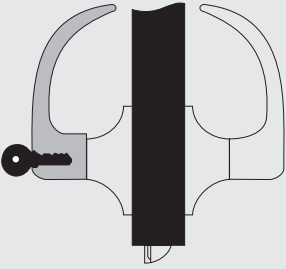
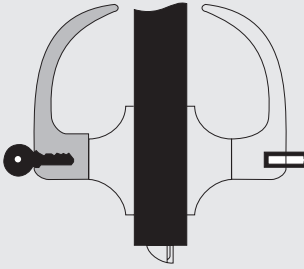
Lever: Cast Zinc
Rose: Wrought Brass



Available with large and small format interchangeable core. See page 12-13 for details.

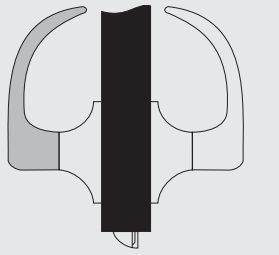
Dimensions shown are in inches/mm.



5401LN (F75)	5402LN (F76A)	5403LN (F77A)
<p>Passage or Closet Latch</p> <ul style="list-style-type: none"> • For doors that do not require locking. • Either lever operates latchbolt at all times.  <p style="text-align: center;">Outside Inside</p>	<p>Privacy, Bedroom or Bath Lock</p> <ul style="list-style-type: none"> • For lavatory or other privacy doors. • Either lever operates latchbolt unless outside lever is locked by pushbutton inside.* • Button automatically releases when inside lever is turned or door is closed. • Emergency release in outside lever. Emergency key supplied. (PN 14-5302-1053-048) • Inside lever always active.  <p style="text-align: center;">Outside Inside</p>	<p>Patio or Privacy Lock</p> <ul style="list-style-type: none"> • For exit doors with limited entry. • Deadlocking latchbolt. • Either lever operates latchbolt unless outside lever is locked by pushbutton inside.* • Button automatically releases when inside lever is turned or door is closed. • Inside lever always active.  <p style="text-align: center;">Outside Inside</p>
5404LN (F82A)	5405LN (F86)	5406LN (F92)
<p>Entry Lock</p> <ul style="list-style-type: none"> • For entrance or office doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked from inside).* • Pushing button in inside lever locks outside lever. (Automatically releases when inside lever is turned or key is rotated in locked outside lever.) • Latchbolt is operated by key in outside lever or by rotating inside lever. • Inside lever always active.  <p style="text-align: center;">Outside Inside</p>	<p>Storeroom or Closet Lock</p> <ul style="list-style-type: none"> • For use on storeroom, utility, and exit doors. • Deadlocking latchbolt. • Latchbolt operated by lever inside, key in outside lever. • Outside lever always locked.* • Inside lever always active.  <p style="text-align: center;">Outside Inside</p>	<p>Service Station Lock</p> <ul style="list-style-type: none"> • Deadlocking latchbolt. • Either lever operates latchbolt. • Pushbutton in inside lever locks outside lever. (Automatically releases when inside lever is turned, door is closed or key is rotated in outside lever, except when slotted pushbutton is rotated 90° clockwise to retain outside lever in locked position.)* • Latchbolt operated by key in outside lever, inside lever always active.  <p style="text-align: center;">Outside Inside</p>

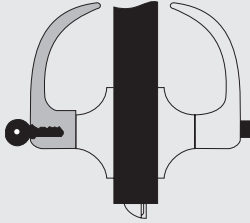
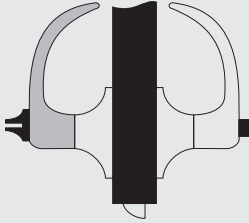
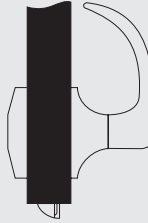
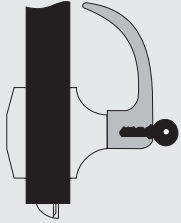
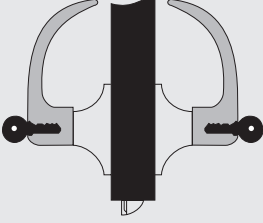
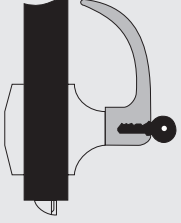
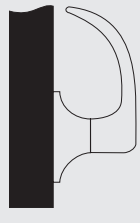
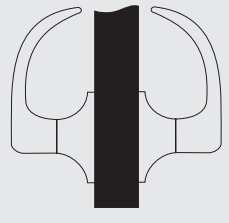
*Lever handles are Free Wheeling in locked position. Shaded area denotes Free Wheeling lever.



5407LN (F109)	5408LN (F84)	5409LN (F89)
<p>Entry Lock</p> <ul style="list-style-type: none"> • For entrance, general home or office doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked from inside).* • Pushing turn button in inside lever locks outside lever, and automatically releases when inside lever is turned or key is rotated in locked outside lever. • Outside lever may be retained in locked position by pushing and rotating turn button 90° clockwise to a horizontal position; not released until turn button is manually returned to the vertical position. • Latchbolt is operated by key in outside lever or by rotating inside lever. • Inside lever always active.  <p style="text-align: center;">Outside Inside</p>	<p>Classroom Lock</p> <ul style="list-style-type: none"> • For classroom or utility room doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked by key).* • Inside lever always active. • Outside lever locked* or unlocked only by key.  <p style="text-align: center;">Outside Inside</p>	<p>Exit Latch</p> <ul style="list-style-type: none"> • For exit doors with no-entry desired. • Deadlocking latchbolt. • Outside lever always locked.* • Inside lever always active.  <p style="text-align: center;">Outside Inside</p>
5417LN (F88)	5418LN (F110)	5421LN (F80)
<p>Apartment, Exit or Public Toilet Lock</p> <ul style="list-style-type: none"> • For office or apartment building entrance doors or lavatory doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked by key from inside).* • Key in outside lever operates latchbolt. • Inside lever always active. <p>NOTE: Inside handle requires 1802S standard 6-pin cylinder.</p>  <p style="text-align: center;">Outside Inside</p>	<p>Intruder Classroom Lock</p> <ul style="list-style-type: none"> • For classroom doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked by key from either side). • Outside lever remains locked upon egress. • Inside lever always active.  <p style="text-align: center;">Outside Inside</p>	<p>Communicating Lock</p> <ul style="list-style-type: none"> • For communicating or store entrance doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when key in either lever locks or unlocks the lever independently of the other).* • Should be used only in offices or rooms with multiple entries. <p>NOTE: Not available with IC core cylinders.</p>  <p style="text-align: center;">Outside Inside</p>

*Lever handles are Free Wheeling in locked position.
Shaded area denotes Free Wheeling lever.



5422LN (F90)	5425LN	5428LN (F111)	5429LN (F113)
<p>Corridor Lock</p> <ul style="list-style-type: none"> • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked by inside pushbutton or key in outside lever). * Inside lever always active. • When locked by button, the button automatically releases when inside lever is turned or door is closed. • When locked by key, the automatic release is made inoperative and must be manually unlocked by the key.*  <p>Outside Inside</p>	<p>Privacy Lock</p> <ul style="list-style-type: none"> • For lavatory or other privacy doors. • Either lever operates latchbolt (except when outside lever is locked by inside pushbutton). * • Button automatically releases by turning inside lever or closing door. • Door can be unlocked, when necessary, by operating outside turnbutton. • No emergency key required. • Optional flush turnbutton available for outside. Specify option "FTB".  <p>Outside Inside</p>	<p>Communicating Passage Lock</p> <ul style="list-style-type: none"> • For twin communicating or exit doors where one side operation is required. • Use where space is limited. • Deadlocking latchbolt. • One lever operation. • Blank rose. • Should be used only where rooms have more than one entrance.  <p>Outside Inside</p>	<p>Communicating Classroom Lock</p> <ul style="list-style-type: none"> • For twin communicating or closet doors where one side operation or space between doors is limited. • Deadlocking latchbolt. • Blank rose. • Inside lever operates latchbolt except when lever is locked by key.* • Should be used only where rooms have more than one entrance. <p>(Not available with IC core cylinders.)</p>  <p>Outside Inside</p>
5430LN (F87)	5439LN (F112)	455LN	455LN-D
<p>Utility, Asylum or Institutional Lock</p> <ul style="list-style-type: none"> • Deadlocking latchbolt. • Latchbolt operated by key in lever from either side. • Both levers always locked.* <p>Note: Not available with IC core cylinders.</p>  <p>Outside Inside</p>	<p>Communicating Storeroom Lock</p> <ul style="list-style-type: none"> • For twin communicating or closet doors where one side operation is required or space between doors is limited. • Deadlocking latchbolt. • Latchbolt operated by key only in inside lever. • Inside lever always locked.* • Blank rose. • Should be used only where rooms have more than one entrance. <p>(Note: Not available with I.C. core cylinders)</p>  <p>Outside Inside</p>	<p>Dummy Trim</p> <ul style="list-style-type: none"> • For non-operational lever used for decorative trim.  <p>Outside Inside</p>	<p>Double Dummy Trim</p> <ul style="list-style-type: none"> • For non-operational lever used for decorative trim.  <p>Outside Inside</p>

*Lever handles are Free Wheeling in locked position. Shaded area denotes Free Wheeling lever.

Electrified Options



Operation

Electric locks provide the ability to electrically lock or unlock the outside trim from a remote location. Fail Safe locks are commonly used in stair towers to release upon fire alarm activation. Fail Secure locks are used on perimeter doors or security doors to allow ingress using access control technologies (proximity cards, keypads, etc.)



Features

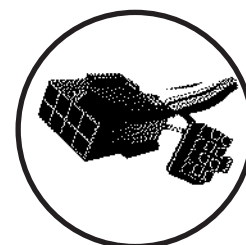
- Free Wheeling lever mechanism.
- Self-contained, continuous-duty integral solenoid (allows installation in standard cylindrical prep).
- Available Fail Safe or Fail Secure.
- Available in 12 or 24 volts DC.
- 8 position ElectroLynx plug connector
- External rectifier available upon request for AC operation.
- Mechanical cylinder override.
- All 5400LN cylinder options.
- Certified ANSI/BHMA Grade 1. 
- UL listed.
- 2-year limited warranty.

Electrical Specifications

- Continuous duty solenoid
150 mA @ 24VDC
300 mA @ 12VDC
- REX (SPDT) Contact Rating:
3A @ 125 VAC
2A @ 24 VDC

Electrolynx®

Yale® electrified 5400LN locks are equipped with ElectroLynx connectors. As a standard feature, these connectors link power from the incoming source to electrified locking products, including hinges, locks, exit devices, magnetic holders and strikes.








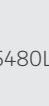

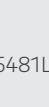
Note: Electrified door hardware with ElectroLynx connectors requires a compatible number of lead wires attached to the door hinge.

Request to Exit (REX) Option

Operating inside lever handle triggers REX switch which can be used to shunt an alarm, monitor egress or release a magnetic lock, etc.

Functions

Outside	Inside	Function	Function Description
		5490LN	Fail Safe <ul style="list-style-type: none"> • Power on locks outside lever. • Inside lever always active. • Latchbolt retracted by key when locked electrically. • Free Wheeling lever when locked electrically.
		5491LN	Fail Secure <ul style="list-style-type: none"> • Power on unlocks outside lever. • Inside lever always active. • Latchbolt retracted by key when power is off. • Free Wheeling lever when power is off (locked).

Outside	Inside	Function	Function Description
		5480LN	Fail Safe <ul style="list-style-type: none"> • Power on locks outside lever. • Inside lever always active. • Latchbolt retracted either side except when outside lever is locked electrically. • Free Wheeling lever when locked electrically.
		5481LN	Fail Secure <ul style="list-style-type: none"> • Power on unlocks outside lever. • Inside lever always active. • Latchbolt retracted either side when power is off. • Free Wheeling lever when power is off (locked).



Electrified Accessories

BPS Power Supplies By Securitron®

Operation

Power supplies are designed to provide reliable filtered and regulated power for long life to a variety of electrified hardware components.

Product Features

- Individual output circuit breakers
- Regulated and filtered fuse protected outputs
- LEDs monitor zone status (voltage or no voltage)
- Slide switches connect or disconnect load from power (Not available on 1 Amp supplies)
- Internal Back-Up battery charging circuit
- Rugged steel enclosure
- Fire alarm interface

Listings

- UL CLASS 2

Applications (use with):

- Fail Safe cylindrical locks
- Fail Secure cylindrical locks

Ordering

Ex: BPS-24-4, BPS-12-3

Model	Input	Output	Application
BPS-24-1	120 VAC	1 Amp @ 24 VDC	2-5400LN
BPS-24-2	120 VAC	2 Amp @ 24 VDC	5-5400LN
BPS-24-4	120 VAC	4 Amp @ 24 VDC	11-5400LN
BPS-12-1	120 VAC	1 Amp @ 12 VDC	1-5400LN
BPS-12-3	120 VAC	3 Amp @ 12 VDC	3-5400LN

Consult factory for additional power supply applications.

Yale recommends McKinney®, Pemko and Securitron® for power transfer devices and other electronic accessories.

Cylinders

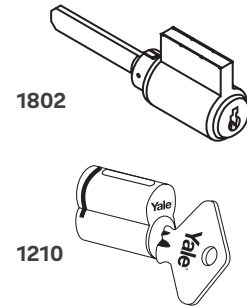


Cylinder Options

The following selection guide indicates the correct cylinder for each locking segment.

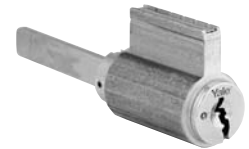
Lockset Series: 5400LN		Types of Cylinder Mechanisms						
		Conventional		Protected Keyway		Security		
Cylinder Types	Fixed Core	6-pin	7-pin	6-pin	7-pin	6-pin	7-pin	
	Key-In-Lever	1802	1802A	K402	K402	5802	5802A	
	Interchangeable Core							
	LFIC	1210	1220	K800	K800	5210	5220	
SFIC	A600	A600	K600	K600	N/A	N/A		

Refer to Yale® KeyMark® and/or Cylinders and Keys Catalog sections for all details and how to order examples.



Yale® KeyMark®

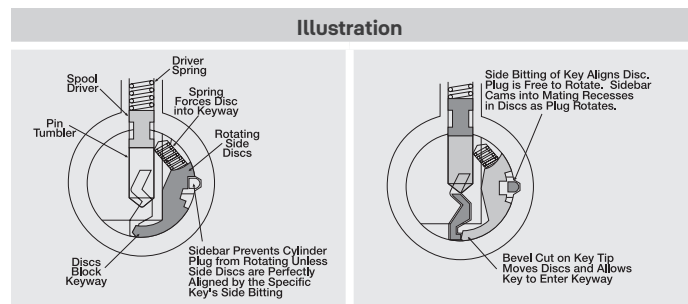
For those applications requiring protected key control, Yale® KeyMark® cylinders guard against unauthorized key duplication. The Yale KeyMark Security Leg® keyway feature increases resistance against picking and impressioning and can easily retrofit into existing systems. For further details and availability, refer to the separate Yale KeyMark catalog.



Security Cylinders

Security cylinders contain two independent locking mechanisms. The first is a traditional 6- or 7-pin tumbler mechanism with spool drivers for greatly increased picking resistance.

The second is an innovative 5-tumbler rotating disc mechanism with sidebar engagement. The rotating discs are spring loaded and block the bottom of the keyway.

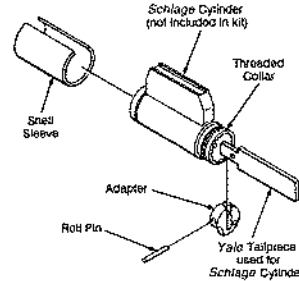


Cylinders



107S Schlage® Cylinder Adapter Kit

Used to modify Schlage cylinder for fit in the 5400LN.
P/N 14-5407-0300-048



Other Manufacturer Keyway Cylinders

Illustration	Description	Model Number	Number of Pins
	Best® Keyway Cylinder. Available keyed random, master keyed or uncombined. Specify keyway A, B, C, D, E, F, G, H, J, K, L or M.	A600	6 or 7
	Corbin Russwin "L4", Corbin "60", Russwin "D1", Sargent® "LA" or Schlage® "E" Keyway. Specify keyway. Available keyed random.	3804*	6
	Schlage® "C" Keyway. Available 0-bitted or keyed random.	2802	6

***3804 cylinders require the 107S cylinder adapter kit to fit the 5400LN locksets. These cylinders are not ANSI/BHMA certified.**

Levers Accepting SFIC And Other Manufacturers' Large Format Interchangeable Cores

Illustration	Description	Prefix	Number of Pins
	SFIC (Accepts all Small Format Interchangeable Cores)	B (i.e. B-AU, B-MO, B-PB)	6 or 7
	Medeco®, ASSA® (LFIC)	M* (i.e. M-AU)	6
	Schlage® (LFIC)	SI (i.e. SI-AU, SI-PB, SI-MO)	6

***Medeco®, ASSA® option available only with AU lever. (Note: For Medeco 32 series cores.)**

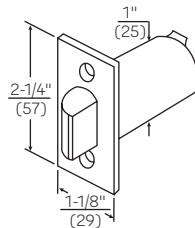
LFIC = Large Format Interchangeable Core

SFIC = Small Format Interchangeable Core



Plain Latchbolts

Model No. 693 supplied standard with all 5400LN series locksets without locking function. Standard plain latchbolt has a 2-1/4" (57mm) x 1-1/8" (29mm) beveled front with a 2-3/4" (70mm) backset and a 1/2" (13mm) bolt throw. Optional latchbolts with a greater backset/throw available to special order.

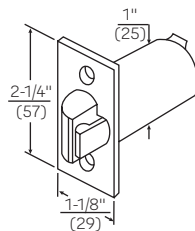


Model No.	Front	Backset	Throw	Front Width	Latch Diameter
693	Beveled	2-3/4" (70mm)	1/2" (13mm)	1-1/8" (29mm)	1" (25mm)
F693	Flat	2-3/4" (70mm)	1/2" (13mm)	1-1/8" (29mm)	1" (25mm)
3693	Beveled	3-3/4" (95mm)	1/2" (13mm)	1-1/8" (29mm)	1" (25mm)

Note: for 3/4" throw applications, only deadlocking latchbolts available.

Deadlocking Latchbolts

Deadlocking latchbolt Model No. 694 supplied standard with all 5400LN series locksets with locking function. Standard deadlocking latchbolt has a 2-1/4" (57mm) x 1-1/8" (29mm) beveled front with a 2-3/4" (70mm) backset and a 1/2" (13mm) bolt throw. Optional latchbolts with a greater backset/throw available to special order.



Model No.	Front	Backset	Throw	Front Width	Latch Diameter
694	Beveled	2-3/4" (70mm)	1/2" (13mm)	1-1/8" (29mm)	1" (25mm)
F694	Flat	2-3/4" (70mm)	1/2" (13mm)	1-1/8" (29mm)	1" (25mm)
3694	Beveled	3-3/4" (95mm)	1/2" (13mm)	1-1/8" (29mm)	1" (25mm)
480B	Beveled	2-3/4" (70mm)	3/4" (19mm)	1-1/8" (29mm)	1" (25mm)
F480B	Flat	2-3/4" (70mm)	3/4" (19mm)	1-1/8" (29mm)	1" (25mm)
3480B	Beveled	3-3/4" (95mm)	3/4" (19mm)	1-1/8" (29mm)	1" (25mm)

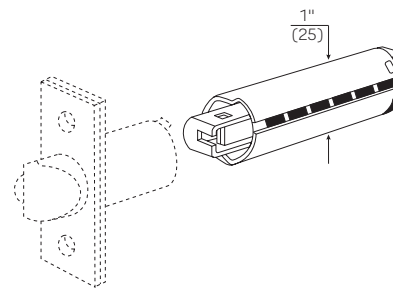
Note: for 2-3/8" backset, contact Customer Support.

Backset Extension Links

All 5400LN Series locksets are supplied with standard latchbolts of 2-3/4" (70mm) backset; optional latchbolts with a 3-3/4" (95mm) backset are available to special order. Extension links are also available for attachment to 2-3/4" (70mm) or 3-3/4" (95mm) backset latchbolts to extend the backset to the desired length.

Desired Backset	Latchbolt Backset	Order Extension List No.
5" (127mm)	2-3/4" (70mm)	481DL
6" (152mm)	3-3/4" (95mm)	481
7" (178mm)	2-3/4" (70mm)	482
8" (203mm)	3-3/4" (95mm)	482
18" (46cm)	2-3/4" (70mm)	484
19" (48cm)	3-3/4" (95mm)	484

Other extension links up to 42" (1.06m) backset are available to special order.



Attaching Screws

(Not regularly supplied when latchbolts ordered separately)

• For all latchbolts

- #8-8-32 x 3/4" (19mm) Phillips flat head combination wood and machine screws
- Brass - P/N 81-2022-0416*
- Bronze - P/N 81-2032-0416*

***Specify finish required.**

• Hollow Metal Doors

- #8 - 32 x 1" (25mm) Phillips flat head machine screw
- Brass - P/N 81-0022-0420*
- Bronze - P/N 81-0032-0420*

Strikes



Yale® 5400LN locks are available with a variety of strike options. All strikes are located on the same vertical and horizontal center lines as the latchbolt. Some strikes are available in special lip lengths to accommodate varying thickness of doors and frames. To determine the proper length of the lip, measure from the center line of the strike to the edge of the jamb, accounting for any interfering trim (i.e. wood molding) and then add 1/4" (6mm) for curved lip. All strikes are reversible. Strikes are fabricated of either brass, bronze or stainless steel, depending on the lockset trim finish. When ordering strikes separately, specify the finish required.

<p>Model No. 497 ANSI Strike (Standard) 1-1/4" supplied standard. 1-1/8", 1-1/2", and 1-3/4" lip lengths available by special order. For door and frames with ANSI/BHMA A156.115 preparations.</p>	<p>Model No. 371 T-Strike (Optional) 1-1/4" curved lip supplied standard. 1", 1-1/2", 1-3/4", and 2" curved lip lengths available by special order. Wrought strike box supplied.</p>	<p>Model No. 497B Blank ANSI Strike (Optional) Available to special order. Installed in frame with standard ANSI/BHMA A156.115 preparation to replace the strike when the lockset has been removed from the door.</p>	<p>Model No. 202 Strike Box for ANSI Strike (Optional) Specify 497 x 202</p>

Attaching Screws

(Not regularly supplied when strikes ordered separately).

For Model No. 371 strike

#8-8-32 x 3/4" (19mm) Phillips flat head combination wood and machine screw P/N-81-2012-0416.

For Model No. 497 strike and 497B plate

#12-12-24 x 1" (25mm) Phillips flat head combination wood and machine screw P/N-81-2012-0620.

Note: When ordering strike plates or attaching screws individually, specify the finish required; i.e. 497 x 202 x 612; #81-2012-0620 x 612.

Technical Specifications and Listings



ADA

The 5400LN meets accessibility guidelines of the Americans with Disabilities Act and the requirements of the Uniform Federal Accessibility Standards and ANSI 117.1, all requiring ease of accessibility for the handicapped.



ISO 9001

Designed and manufactured under a certified ISO 9001 quality system.

ANSI/BHMA

Certified ANSI/BHMA A156.2, Series 4000 Grade 1.



Knurled Designs

Where required by the local authority, 5400LN trim can be knurled to be identifiable to the touch for blind persons. All lever designs in all finishes may be ordered knurled. Only the outside lever will be knurled unless specified otherwise.

Door Thickness

Adjustable rose support plates allow the 5400LN to easily adjust to doors from 1-3/4" to 2" thick. It can also be used on 1-3/8" thick doors by adding two spacer plates P/N 14-5401-6644. For 2-1/4" thick doors, please specify door thickness on order.

Warranty

The 5400LN Series cylindrical lever lock carries a seven-year warranty. The 5400LN carries a lifetime warranty against lever sag and lever spring breakage.

Fire Listings

UL/cUL Listed for all fire door functions up to 3 hours.

Note: Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Yale Locks & Hardware makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.



Windstorm

Certified (refer to local codes). 5400LN Series can be provided to meet FEMA 320 standards. See page 4 for How to Order.



Hurricane



Tornado

Installation

5400LN Series Cylindrical Locks conform to ANSI/BHMA Specifications A156.115 which cover hardware preparations for steel doors and steel frames and A156.115-W which cover hardware preparations for wood doors with wood or steel frames.

Mechanical Functions



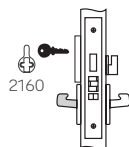
8820 Hotel Guest Lock (F15)

- Latchbolt retracted by key outside, knob/lever inside
- Latchbolt retracted by master keys and change keys only when deadbolt is NOT projected
- Deadbolt operated by emergency/shut-out or display key outside and thumbturn inside
- When deadbolt is projected, the indicator shows red with a locked padlock icon (indicating room is occupied). Access from outside can be gained only with an emergency/shut-out or display key.
- Outside knob/lever rigid at all times
- Anti-panic operation. Operating inside knob/lever retracts the latchbolt and deadbolt simultaneously
- Deadlocking latchbolt
- **Master key system must be 7-pin**

Note: CIND indicator provided standard. V series indicators must be specified by option code. Indicator shows deadbolt position only.



Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8820K	8820FL	3/4"
SL	—	SL8820FL	3/4"
Reflections*	—	8820RL	3/4"



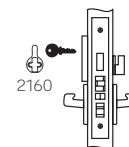
8827 Hotel/Motel Lock

- Latchbolt retracted by knob/lever either side, except when outside knob/lever is independently locked by stopwork activator or automatically locked when the deadbolt is projected
- Latchbolt retracted by master keys and change keys only when deadbolt is NOT projected
- Deadbolt operated by emergency/shut-out or display key outside and thumbturn inside
- When deadbolt is projected, the indicator shows red with a locked padlock icon (indicating room is occupied). Access from outside can be gained only with an emergency/shut-out or display key.
- Anti-panic operation. Operating inside knob/lever automatically retracts latchbolt and deadbolt with outside knob/lever remaining locked.
- Deadlocking latchbolt
- **Master key system must be 7-pin**

Function only available with CO, R6, R7, R8 roses or CN escutcheon
Note: CIND indicator provided standard. V series indicators must be specified by option code. Indicator shows deadbolt position only.



Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8827K	8827FL	3/4"	1"
SL	—	SL8827FL	3/4"	1"
Reflections*	—	8827RL	3/4"	1"

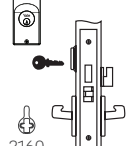


8822 Dormitory Or Exit Lock (F13)

- Latchbolt retracted by knob/lever either side
- Deadbolt operated by key outside and thumbturn inside
- When the deadbolt is projected, outside knob/lever is automatically locked
- Anti-panic operation. Operating inside knob/lever retracts the latchbolt and deadbolt simultaneously, automatically unlocking outside knob/lever.



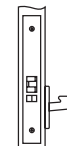
Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8822K	8822FL	3/4"	1"
SL	—	SL8822FL	3/4"	1"
Reflections*	—	8822RL	3/4"	1"



8828 Exit Or Communicating Lock (F31)

- For twin communicating or exit doors where one-sided operation is required
- Latchbolt retracted by knob/lever inside at all times
- No outside operations
- Deadlocking latchbolt

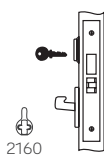
Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8828K	8828FL	3/4"
SL	—	SL8828FL	3/4"
Reflections*	—	8828RL	3/4"



8823 Storeroom Lock

- Latchbolt retracted by knob/lever outside
- Deadbolt operated by key outside
- When deadbolt is projected, outside knob/lever is automatically locked
- No inside knob/lever or cylinder

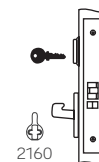
Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8823K	8823FL	3/4"	1"
SL	—	SL8823FL	3/4"	1"
Reflections*	—	8823RL	3/4"	1"



8829 Closet Lock

- Latchbolt retracted by knob/lever outside
- Outside cylinder locks or unlocks outside knob/lever
- No inside knob/lever or cylinder
- Deadlocking latchbolt

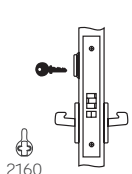
Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8829K	8829FL	3/4"
SL	—	SL8829FL	3/4"
Reflections*	—	8829RL	3/4"



8824 Holdback Lock (F06)

- For classroom, office, or utility room doors
- Latchbolt retracted by knob/lever either side, except when outside knob/lever is locked by key outside
- Latchbolt can be held in retracted position by outside cylinder
- Inside knob/lever always active
- Deadlocking latchbolt
- NOT UL listed

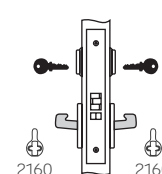
Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8824K	8824FL	3/4"
SL	—	SL8824FL	3/4"
Reflections*	—	8824RL	3/4"



8830-2 Asylum Or Institutional Lock (F30)

- Latchbolt retracted by key both sides
- Rigid knob/lever both sides for use as pulls only
- Deadlocking latchbolt

Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8830-2K	8830-2FL	3/4"
SL	—	SL8830-2FL	3/4"
Reflections*	—	8830-2RL	3/4"



Indicator options available for both sectional and escutcheon trim.

Cylinder cam required.

Indicates rigid knob/lever.

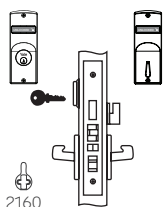


8847 Apartment Corridor Door Lock (F20)

- Latchbolt retracted by knob/lever either side, except when outside knob/lever is locked by stopwork activator
- Deadbolt operated by key outside, thumbturn inside
- When outside knob/lever is locked, latchbolt and deadbolt are operated by key outside
- When deadbolt is projected, outside knob/lever is automatically locked
- Anti-panic operation. Operating inside knob/lever automatically retracts latchbolt and deadbolt with outside knob/lever remaining locked.
- Deadlocking latchbolt

Note: Indicator shows deadbolt position only

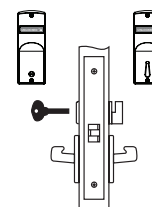
Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8847K	8847FL	3/4"	1"
SL	—	SL8847FL	3/4"	1"
Reflections*	—	8847RL	3/4"	1"



8862 Privacy, Bedroom Or Bath Lock (F22)

- Latchbolt retracted by knob/lever either side except when outside knob/lever is locked by thumbturn
- Operating inside knob/lever retracts the latchbolt, automatically unlocking outside knob/lever
- Outside emergency release unlocks outside knob/lever. E203 emergency key supplied
- Automatically unlocks when door latches

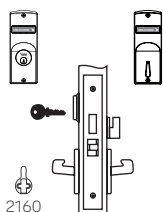
Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8862K	8862FL	3/4"
SL	—	SL8862FL	3/4"
Reflections*	—	8862RL	3/4"



8860 Room Door Lock (F21)

- Latchbolt retracted by knob/lever either side
- Deadbolt operated by key outside, thumbturn inside

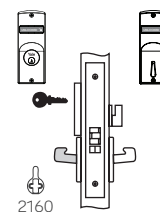
Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8860K	8860FL	3/4"	1"
SL	—	SL8860FL	3/4"	1"
Reflections*	—	8860RL	3/4"	1"



8864 Bathroom Lock With Indicator

- Latchbolt retracted by key outside, knob/lever inside
 - Indicator operated by thumbturn inside, key outside
 - When indicator shows red with a locked padlock icon, key outside will operate indicator and retract latchbolt
 - Outside knob/lever rigid at all times
 - Inside knob/lever always active
 - Deadlocking latchbolt
 - Function only available with C0, R6, R7, R8 roses or CN escutcheon
- Note: CIND indicator provided standard. V series indicators must be specified by option code.

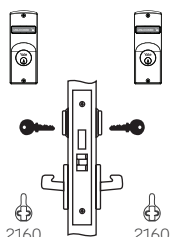
Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8864K	8864FL	3/4"
Reflections*	—	8864RL	3/4"



8860-2 Store Door Lock (F14)

- Latchbolt retracted by knob/lever either side
- Deadbolt operated by key both sides

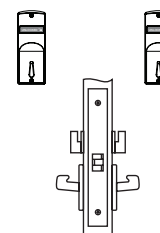
Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8860-2K	8860-2FL	3/4"	1"
SL	—	SL8860-2FL	3/4"	1"
Reflections*	—	8860-2RL	3/4"	1"



8865 Bathroom Lock

- Latchbolt retracted by knob/lever either side except when outside knob/lever is locked by thumbturn either side
- Outside thumbturn unlocks outside knob/lever
- Automatically unlocks when door latches
- Operating inside knob/lever retracts the latchbolt, automatically unlocking outside knob/lever

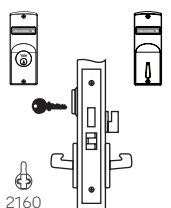
Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8865K	8865FL	3/4"
SL	—	SL8865FL	3/4"
Reflections*	—	8865RL	3/4"



8861 Dormitory Or Storeroom Lock

- Latchbolt retracted by knob/lever either side
- Deadbolt operated by key outside, thumbturn inside
- When deadbolt is projected, outside knob/lever is automatically locked
- When deadbolt is retracted, outside knob/lever is automatically unlocked

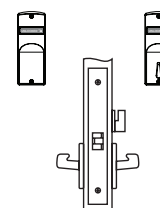
Trim	Model Numbers		Throw	
	Knobs	Levers	Latchbolt	Deadbolt
Standard	8861K	8861FL	3/4"	1"
SL	—	SL8861FL	3/4"	1"
Reflections*	—	8861RL	3/4"	1"



8866 Passage Lock With Indicator

- For doors with indicator that do not require locking
 - Latchbolt retracted by knob/lever either side at all times
 - Throwing thumbturn on inside changes state of status indicator
 - Rotating either knob/lever returns indicator to previous state
- Note: Only available with "V" series indicators. Indicator option code must be specified with this function

Trim	Model Numbers		Latchbolt Throw
	Knobs	Levers	
Standard	8866K	8866FL	3/4"
Reflections*	—	8866RL	3/4"



Indicator options available for both sectional and escutcheon trim.

Cylinder cam required.

Indicates rigid knob/lever.



features

squarebolt® exit device

A revolutionary security and safety exit device from Yale®, the *SquareBolt* patented design (Pat. no. 5,605,362) presents an improved physical barrier over standard rim latchbolts.



Available in wide stile, narrow stile, and narrow appearance designs, the *SquareBolt* exit device locks into place and stays there. Credit cards, crowbars, door rattling and shaking are resisted, significantly reducing the threat of unauthorized entry.

electrified exit devices

The *Yale* 7000 series exit device offers a complete range of electrical options:

- Latch Pullback
- Electric Dogging
- Mortise Device Trim Control
- Touchbar Monitor or Signaling
- Outside Trim Monitor or Signaling
- Latchbolt Position Monitor or Signaling
- Delayed Egress (Pat. no 7,469,942)
- Electric Trim Control
- Exit Alarm

Continuity in appearance, security and functions with the 7000 Series mechanical exit devices is maintained.

7000 series electrified exit devices may be integrated into the security and alarm monitoring systems of most buildings.

windstorm

Certified (refer to local Hurricane codes). Specify suffix "WS" to 7150(F), 7170(F) or 7250M(F) devices.



Hurricane

warranty

- Mechanical exit devices and heavy-duty trim carry a five-year limited warranty.
- Utility-duty trim carries a one-year limited warranty.
- Electrical options and components carry a two-year limited warranty.

microshield®

7000 series exit devices and trim are available with *MicroShield*® antimicrobial coating. *MicroShield* is a revolutionary hardware finish coating, using a silver ion based technology, which inhibits the growth of bacteria, algae, yeast, fungus, mold and mildew. *MicroShield* is non-toxic and lasts for the lifetime of the finish to which it is applied. To order, suffix option code "YMS".



Note: *MicroShield* coating may vary finish color from architectural standards. *MicroShield* is not intended as a substitute for traditional infection control programs such as hand hygiene or use of disinfectants. Coated products must still be cleaned to insure the surfaces will be free of destructive microbes. Yale makes no representations or warranties, express or implied, as to the efficacy of the *MicroShield* antimicrobial. A copy of the *MicroShield* warranty is available upon request.

lumi-lite®

Lumi-lite uses photoluminescence technology to provide visibility of exit doors in low-light, no light or smokey conditions. *Lumi-lite* absorbs ambient lighting which is then emitted when the light source is diminished or eliminated. This patent pending feature is provided as an option for the touchpad cover for the 7000 series exit devices. To order with device, suffix option code "LUM".

The touchpad cover can also be ordered separately and easily retrofits to existing 7000 series exit devices in the field. See page 48 for how to order separately.

Touchpad cover comes standard with the word "EXIT" centered on the top half in approximately 1" high lettering.



performance standards

UL - cUL Panic Exit Listing: Doors up to 4'0" x 10'0"* (1.22m x 3.05m), single swing or pairs.

UL - cUL Fire Exit Label: Doors up to 4'0" x 10'0" (1.22m x 2.44m), single swing or pairs.

*UL does not set height limitations on panic devices.

Listing Agency	Listing Number			
	Panic Exit Devices	Fire Exit Devices	Windstorm Rated Assembly	Latching Hardware
Underwriters Laboratories, Inc.	(FVSR)	(GXHX)	(ZHLA)	(ZHEM)
California Fire Marshal	4140-0257: 111	3725-0257: 112		
New York City	MEA: 477-91-E MEA: 333-05-M			
B.H.M.A. (ANSI A156.3)	Directory of Certified Exit Devices			
B.H.M.A. (ANSI A156.24)	Directory of Certified Delayed Egress Exit Devices			

Note: Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Yale Locks & Hardware makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

free-wheeling lever trim

All *Yale* exit device trims (except mortise trim) feature the unique Free-Wheeling lever mechanism, similar to our 5400LN cylindrical lock. This Free-Wheeling trim features a clutch mechanism which allows the lever to float down 60 degrees when operated in the locked condition, greatly improving vandal resistance.



functions

knob or lever trims

SquareBolt® 7150(F) 7250 7250M(F)		Rim 7100(F) 7200 7200M(F)		Surface Vertical Rod 7110(F) 7170(F) 7210 7210M(F)		Concealed Vertical Rod 7120(F) 7160(F) 7220 7220M(F)		Mortise 7130(F)		Type	ANSI Function No.	Function Description
Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside			
										Exit Only/ Blank Plate	01 –	Exit only, no trim. Exit only, blank plate.
										Dummy	02	Entrance by trim when actuating bar is locked down.
										Nightlatch	03	Entrance by trim when latchbolt is retracted by key. Key removable only when locked.
										Classroom	08	Entrance by knob or lever. Key locks or unlocks knob or lever.
										Storeroom	09	Entrance by knob or lever only when released by key. Key removable only when locked.
										Passage	14	Entrance by trim when latchbolt is released by knob or lever. Knob or lever always active, no cylinder.

Note: 09 and Free-Wheeling 02 achieved with a single modification at installation.

double cylinder exit device lever trims

SquareBolt® 7150(F)-2		Rim 7100(F)-2		Mortise 7130(F)-2		Type	ANSI Function No.	Function Description
Inside	Outside	Inside	Outside	Inside	Outside			
						Classroom	08	Entrance by lever. Key either side locks or unlocks lever.

functions

thumbpiece, thumbturn and pull trims

SquareBolt® 7150(F) 7250 7250M(F)		Rim 7100(F) 7200 7200M(F)		Surface Vertical Rod 7110(F) 7170(F) 7210 7210M(F)		Concealed Vertical Rod 7120(F) 7160(F) 7220 7220M(F)		Mortise 7130(F)		Type	ANSI Function No.	Function Description
Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside			
										Exit Only/ Blank Plate	01 –	Exit only, no trim. Exit only, blank plate.
										Dummy/ Pull Plate	02	Entrance by trim when actuating bar is locked down.
										Nightlatch	03	Entrance by trim when latchbolt is retracted by key. Key removable only when locked.
										Classroom	05	Entrance by thumbpiece. Key locks or unlocks thumbpiece.
										Storeroom	06	Entrance by thumbpiece only when released by key. Key removable only when locked.
										Passage	15	Entrance by trim when latch is released by thumbpiece. Thumbpiece is always active, no cylinder.
										Classroom	11	Entrance by control turn piece. Key locks or unlocks control.
										Storeroom	12	Entrance by control turn piece only when released by turning key. Key removable only when locked.


Note: 06 and 12 achieved with a single modification at installation.

7100 series applications

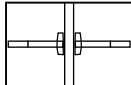
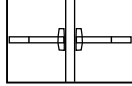
introduction

The 7100 is the perfect choice for wide stile panic and fire-rated applications. The smooth architectural lines provide pleasing aesthetics to accent a building's appearance, and looks aren't always deceiving. Beneath the strong exterior lie the components to meet the demanding security and access control needs of today. The delayed egress option is just one of the many SecureX® electromechanical options offered to enhance security. Complementing the 7100 series with the 600F series heavy-duty trim completes the package for a heavy-duty, security hardware package.

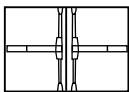
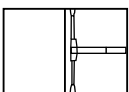
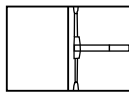
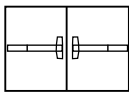
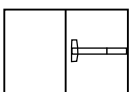
applications

Single Door	UL Listing	Maximum Opening	Application	
SquareBolt®				
7150/7150-2	Panic	4' x *	Surface applied; single-point latching.	
7150F/7150F-2	3 Hr.	4' x 8'		
7150WS	Panic	4' x 8'		
7150FWS	3 Hr.	4' x 8'		
Rim				
7100/7100-2	Panic	4' x *	Surface applied; single-point latching.	
7100F/7100F-2	3 Hr.	4' x 8'		
Mortise				
7130/7130-2	Panic	4' x *	Mortised in door; single-point latching.	
7130F/7130F-2	1-1/2 Hr.	4' x 9'		
7130F/7130F-2	3 Hr.	4' x 8'		
Surface Vertical Rod				
7110	Panic	4' x 8'	Surface applied; two-point latching.	
7170	Panic	4' x 10'		
7170 x LBR	Panic	4' x 10'	Surface applied; one-point latching.	
7170WS	Panic	4' x 8'	Surface applied; two-point latching. Used as components in swinging door windstorm-rated assemblies (refer to local codes).	
Concealed Vertical Rod				
7120	Panic	4' x 8'	Rods concealed in door; two-point latching.	
7160	Panic	4' x 10'		
7160 x LBR	Panic	4' x 10'		

*UL does not set a door height limitation on panic applications.

Pair of Doors with Removable Mullion	UL Listing	Maximum Opening	Application	
SquareBolt® x SquareBolt®				
7150 x 7150 x M200 Series	Panic	8' x 10'	Two independent active doors with removable mullion. Used as components in swinging door windstorm-rated assemblies (refer to local codes).	
7150F x 7150F x M200F Series	3 Hr.	8' x 8'		
7150WS x 7150WS x M200FWS	Panic	8' x 8'		
7150FWS x 7150FWS x M200FWS	3 Hr.	8' x 8'		
Rim x Rim				
7100 x 7100 x M200 Series	Panic	8' x 10'	Two independent active doors with removable mullion.	
7100F x 7100F x M200F Series	3 Hr.	8' x 8'		

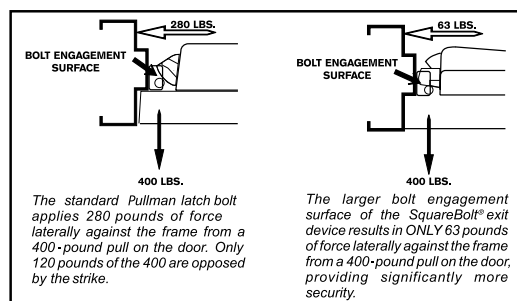
7100 series applications

Pair of Doors	UL Listing	Maximum Opening	Application	
Surface Vertical Rod				
7110 x 7110	Panic	8' x 8'	Two independent doors with two-point latching, swinging in the same direction.	
7110F x 7110F	3 Hr.	8' x 8'		
7170 x 7170	Panic	8' x 10'	Two independent doors with one- or two-point latching, swinging in the same direction.	
7170F90 x 7170F90	1-1/2 Hr.	8' x 10'		
7170F x 7170F	3 Hr.	8' x 8'	Two independent doors with two-point latching, swinging in opposite directions. Used as components in swinging door windstorm-rated assemblies (refer to local codes).	
7170WS x 7170WS	Panic	8' x 8'		
7170FWS x 7170FWS	1-1/2 Hr.	8' x 8'		
Surface Vertical Rod (Double Egress)				
7110 x 7110	Panic	8' x 8'	Two independent doors with two-point latching, swinging in opposite directions. Overlapping astragal required for 3-hour openings.	
7110F x 7110F	3 Hr.	8' x 8'		
7170 x 7170	Panic	8' x 10'	Two independent doors with one- or two-point latching, swinging in opposite directions. Overlapping astragal not required.	
7170F90 x 7170F90	1-1/2 Hr.	8' x 10'		
7170F x 7170F	3 Hr.	8' x 8'		
Surface Vertical Rod x Mortise				
7110 x 7130	Panic	8' x 8'	Overlapping astragal required for 3-hour openings. Coordinator required with standard ANSI strike.	
7110F x 7130F	3 Hr.	8' x 8'		
7110F x 7130F x Open Back Strike	1-1/2 Hr.	8' x 8'	Overlapping astragal required for fire-rated openings. Coordinator required with standard ANSI strike.	
7170 x 7130	Panic	8' x 10'		
7170F90 x 7130F	1-1/2 Hr.	8' x 9'		
Concealed Vertical Rod				
7120 x 7120	Panic	8' x 8'	Two independent metal doors with two-point latching, swinging in the same direction.	
7120F x 7120F	3 Hr.	8' x 8'		
7160 x 7160	Panic	8' x 10'	Two independent metal or wood doors with one- or two-point latching, swinging in the same direction.	
7160F90 x 7160F90	1-1/2 Hr.	8' x 10'		
7160F x 7160F	3 Hr.	8' x 8'		
Concealed Vertical Rod (Double Egress)				
7120 x 7120	Panic	8' x 8'	Two independent metal doors with two-point latching, swinging in opposite directions. Overlapping astragal required for 3-hour openings.	
7120F x 7120F	3 Hr.	8' x 8'		
7160 x 7160	Panic	8' x 10'	Two independent metal or wood doors with one- or two-point latching, swinging in opposite directions. Overlapping astragal not required.	
7160F90 x 7160F90	1-1/2 Hr.	8' x 10'		
7160F x 7160F	3 Hr.	8' x 8'		

SquareBolt®

7150(F)

Just as easy to open as traditional latchbolts, the SquareBolt® exit device's unique construction offers innovative protection. Its patented *SquareBolt* (Pat. no. 5,605,362) design presents an improved physical barrier over standard rim latchbolts. The *SquareBolt* exit device locks into place and stays there. Credit cards, crowbars, door rattling and shaking are resisted, significantly reducing the threat of unauthorized entry.




certification/compliance

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
 GXHX/GXHX7 - Fire exit hardware (F)
 (4' x 8' single, 8' x 8' pairs, 3 hr.)
 ZHEM - Latching hardware
 ZHLA - Windstorm rated assemblies

ANSI/BHMA Certified: A156.3 Type 1 or 28, Grade 1
 U.S. Patent #: 5,605,362



features

- Patented *SquareBolt* security deadbolt (Pat. no. 5,605,362) designed for maximum holding power
- Non-handed for easy installation
- Can be retrofitted onto existing 7100 series templated doors
- Fully adjustable surface-mounted 3/8" diameter roller strike complete with positive locking plate and shims
- Available in double cylinder function (handing must be specified)
- Available certified hurricane resistant  Hurricane (refer to local codes). Specify 7150(F)WS

applications

- Single swing doors
- Pairs of doors with removable mullions
- Metal, wood or composite door materials

specifications

Door Opening Width:	-24 for 24" (60cm) doors -36 for 30" - 36" (76cm - 91cm) doors -48 for 36" - 48" (91cm - 122cm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. Optional door thicknesses available to 4-1/2"; specify door thickness when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Deadbolt:	Patented 1" (25mm) slide projection bolt with full 3/4" (19mm) projection
Strike:	757F, 793 optional (double door application, panic only)
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F series escutcheon trim, 630F series pull/thumbpiece trim, 680F series offset pull trim, 540F series rose trim, 121NL cylinder only. See pages 27-29.
Dogging:	Hex key dogging supplied standard on panic devices
Options:	Cylinder dogging, shim kit #723, sex nuts and bolts, MicroShield®, Lumi-Lite®
Warranty:	5-year limited

rim

7100(F)

The 7100(F) is a rim exit device to be used with single doors or pairs of doors constructed of metal, wood or composite materials. Designed for application in high-use areas, the 7100(F) comes in a variety of finishes and can be combined with a variety of trims to match any desired style.



certification/compliance

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(4' x 8' single, 8' x 8' pairs, 3 hr.)

ANSI/BHMA Certified: A156.3 Type 1, Grade 1



features

- Designed for wide stile doors
- 3/4" throw deadlocking stainless steel pullman latchbolt
- Electroplated ferrous components provide corrosion resistance
- Available in double cylinder function (handing must be specified)

applications

- Non-handed for easy installation
- Single swing doors
- Pairs of doors with removable mullions
- Metal, wood or composite door materials

specifications

Door Opening Width:	-24 for 24" (60cm) doors -36 for 30" - 36" (76cm - 91cm) doors -48 for 36" - 48" (91cm - 122cm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. Optional door thicknesses available to 4-1/2"; specify door thickness when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	3/4" (19mm) deadlocking stainless steel pullman-type
Strike:	757F, 793 optional (double door application, panic only)
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F series escutcheon trim, 630F series pull/thumbpiece trim, 680F series offset pull trim, 540F series rose trim, 121NL cylinder only. See pages 27-29.
Dogging:	Hex key dogging supplied standard on panic devices
Options:	Cylinder dogging, shim kit #723, sex nuts and bolts, MicroShield®, Lumi-Lite®
Warranty:	5-year limited


surface vertical rod

7110(F)

The 7110(F) is a surface vertical rod exit device to be used on wide stile or flush doors up to 8' (fire) and 10' (panic) where two-point latching is desired.

certification/compliance

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
 GXHX/GXHX7 - Fire exit hardware (F)
 (8' x 8' pairs, 3 hr.)

ANSI/BHMA Certified: A156.3 Type 2, Grade 1 

features

- Designed for wide stile and flush doors
- Handed. Specify hand (field reversible)
- Bottom deadbolt for secure latching
- Fully adjustable roller strike

applications

- Pairs of doors
- Double egress
- Metal, wood or composite door materials

specifications

Door Opening Width:	-24 for 24" (60cm) doors -36 for 30" - 36" (76cm - 91cm) doors -48 for 36" - 48" (91cm - 122cm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height 7' (213cm), with the device centerline at 39-15/16" (101cm) from floor. Optional heights up to 8' (fire) and 10' (panic) available by using rod extensions. For fire rated openings over 8', see 7170F SVR.
Door Thickness:	1-3/4" (44mm) standard. Optional door thicknesses available to 4-1/2"; specify door thickness when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, pullman-type with automatic deadlatching Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
Vertical Rods:	1/2" O.D. tubular brass, bronze or stainless steel with rod guides
Strike:	Top: Roller type 791. Bottom: Flush mounted 790. 794 floor strike optional (threshold openings).
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F series escutcheon trim, 630F series pull/thumbpiece trim, 680F series offset pull trim, 540F series rose trim. See pages 27-29.
Dogging:	Hex key dogging supplied standard on panic devices
Options:	Cylinder dogging, shim kit #724, sex nuts and bolts, rod extensions, bottom pullman latch (panic only) MicroShield®, Lumi-Lite®
Warranty:	5-year limited



surface vertical rod

7170(F)

The 7170(F) is a surface vertical rod exit device to be used on wide stile and flush doors up to 10' where one- or two-point latching is desired. A Less Bottom Rod (LBR) option is available.

certification/compliance

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
 GXHX/GXHX7 - Fire exit hardware (F)
 (8' x 10' pairs, 1-1/2 hr.)
 (8' x 8' pairs, 3 hr.)
 ZHEM - Latching hardware
 ZHLA - Windstorm rated assemblies

ANSI/BHMA Certified: A156.3 Type 2, Grade 1



features

- Designed for wide stile and flush doors
- Handed. Specify hand (field reversible)
- Interlocking top strike and latch mounting plate
- Available less bottom rod (LBR option)
- Available certified hurricane resistant (refer to local codes ~ not approved for LBR). Specify 7170(F)WS

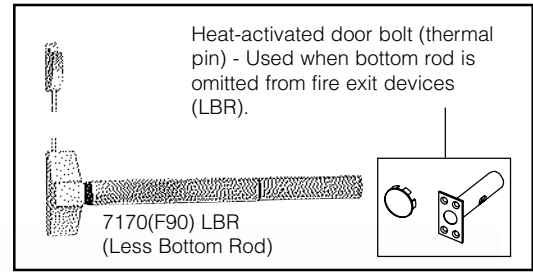


applications

- Pairs of doors
- Double egress
- Metal or wood doors

specifications

Door Opening Width:	-24 for 24" (60cm) doors -36 for 30" - 36" (76cm - 91cm) doors -48 for 36" - 48" (91cm - 122cm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height 7' (213cm), with the device centerline at 39-15/16" (101cm) from floor. Optional heights specify suffix -8, -9, -10.
Door Thickness:	1-3/4" (44mm) standard. Optional door thicknesses available to 4-1/2"; specify door thickness when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, pullman-type with automatic deadlatching Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
Vertical Rods:	1/2" O.D. tubular brass, bronze or stainless steel with rod guides
Strike:	Top: 726. Bottom: Flush-mounted 790. 794 floor strike optional (threshold openings).
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F series escutcheon trim, 630F series pull/thumbpiece trim, 680F series offset pull trim, 540F series rose trim. See pages 27-29.
Dogging:	Hex key dogging supplied standard on panic devices
Options:	Cylinder dogging, shim kit #724, sex nuts and bolts, bottom pullman latch (panic only), less bottom rod (LBR), -8, -9, -10 opening height, rod extensions, MicroShield®, Lumi-Lite®.
Warranty:	5-year limited



concealed vertical rod

7120(F)

The 7120(F) is a concealed vertical rod exit device to be used on metal doors only up to 8' (fire) and 10' (panic) where two-point latching is desired.

certification/compliance

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
 GXHX/GXHX7 - Fire exit hardware (F)
 (8' x 8' pairs, 3 hr.)

ANSI/BHMA Certified: A156.3 Type 8, Grade 1



features

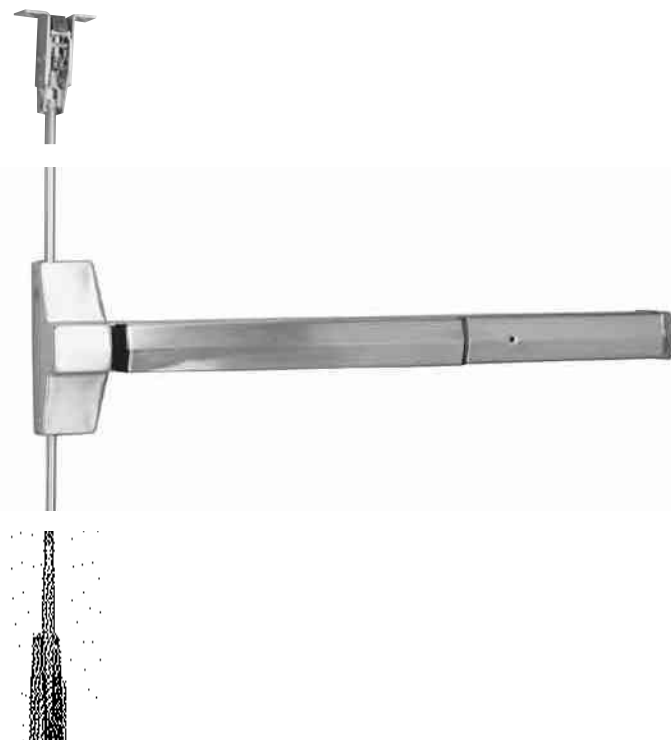
- Designed for wide stile and flush doors
- Handed. Specify hand (field reversible)
- Bottom deadbolt for secure latching
- Fully adjustable roller strike

applications

- Pairs of doors
- Double egress
- Metal doors only

specifications

Door Opening Width:	-24 for 24" (60cm) doors -36 for 30" - 36" (76cm - 91cm) doors -48 for 36" - 48" (91cm - 122cm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height adjustable to 8' (244cm), with the device centerline at 39-15/16" (101cm) from floor. Optional heights up to 10' (panic) available by using rod extensions. For fire rated openings over 8', see 7160F CVR.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, pullman-type with automatic deadlatching Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
Vertical Rods:	1/2" (13mm) O.D. telescoping tubular rods
Strike:	Top: Roller type 791 (panic and fire). Bottom: Flush mounted 790 (panic and fire). 794 floor strike optional (threshold openings).
Fasteners:	Machine screws standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F series escutcheon trim, 630F series pull/thumbpiece trim, 680F series offset pull trim, 540F series rose trim. See pages 27-29.
Dogging:	Hex key dogging supplied standard on panic devices
Options:	Cylinder dogging, shim kit #723, sex nuts and bolts, rod extensions, bottom pullman latch (panic only) MicroShield®, Lumi-Lite®
Warranty:	5-year limited



concealed vertical rod

7160(F)

The 7160(F) is a concealed vertical rod exit device to be used on wood and metal doors up to 10' where one- or two-point latching is desired. A Less Bottom Rod (LBR) option is available.

certification/compliance

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(8' x 10' pairs, 1-1/2 hr.)
(8' x 8' pairs, 3 hr.)

ANSI/BHMA Certified: A156.3 Type 7 and 8, Grade 1



features

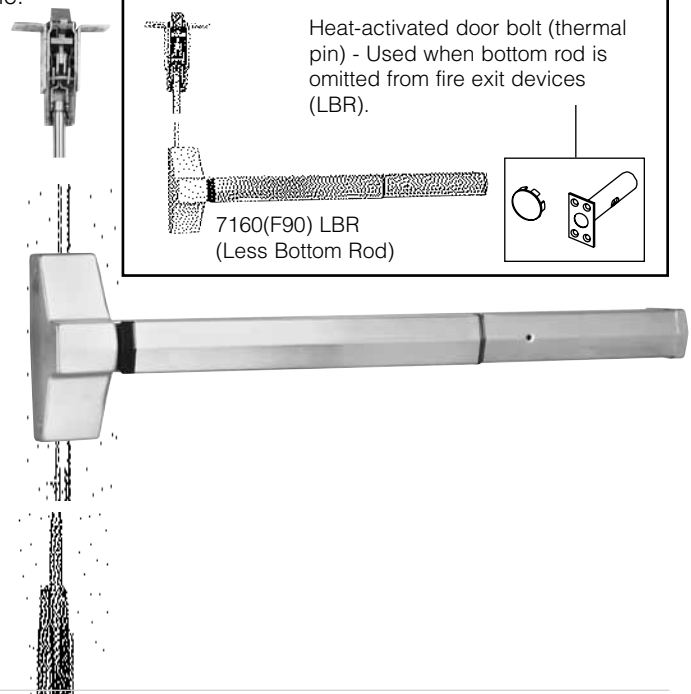
- Designed for wide stile and flush doors
- Handed. Specify hand (field reversible)
- Mortised top strike
- Available less bottom rod (LBR option)

applications

- Pairs of doors
- Double egress
- Metal, wood, or composite door materials

specifications

Door Opening Width:	-24 for 24" (60cm) doors -36 for 30" - 36" (76cm - 91cm) doors -48 for 36" - 48" (91cm - 122cm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height adjustable to 8' (244cm), with the device centerline at 39-15/16" (101cm) from floor. Optional heights specify suffix -9, -10.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, pullman-type with automatic deadlatching Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
Vertical Rods:	1/2" (13mm) O.D. telescoping tubular rods
Strike:	Top: Mortised 761. Bottom: Flush mounted 790. 794 floor strike optional (threshold openings).
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F series escutcheon trim, 630F series pull/thumbpiece trim, 680F series offset pull trim, 540F series rose trim. See pages 27-29.
Dogging:	Hex key dogging supplied standard on panic devices
Options:	Cylinder dogging, shim kit #723, sex nuts and bolts, less bottom rod (LBR), -9, -10 opening height, rod extensions, bottom pullman latch (panic only), MicroShield®, Lumi-Lite®.
Warranty:	5-year limited



mortise

7130(F)

The 7130(F) is an exit device integrated with the Yale® 8700 Series Mortise Lock for use on single doors or active leaf of a pair of doors where life safety and extra security are required. The 8700 Series Mortise Lock used is modified for use with exit devices only.

certification/compliance

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
 GXHX/GXHX7 - Fire exit hardware (F)
 (4' x 8' single, 8' x 8' pairs, 3 hr.)
 (4' x 9' single, 8' x 9' pairs, 1-1/2 hr.)

ANSI/BHMA Certified: A156.3 Type 3, Grade 1



features

- Designed for wide stile and flush doors
- Handed; specify hand
- Two-piece mechanical 3/4" throw deadlocking stainless steel latchbolt
- Easily disassembles for maintenance and service
- Available in double cylinder function

applications

- Single swing doors
- Pairs of doors with vertical rod devices or automatic flush bolts
- Metal, wood or compatible door materials

specifications

Door Opening Width:	-24 for 24" (60cm) doors -36 for 30" - 36" (76cm - 91cm) doors -48 for 36" - 48" (91cm - 122cm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Two piece mechanical 3/4" (19mm) deadlocking stainless steel with anti-friction insert and auxiliary deadlocking latch
Strike:	Curved lip, non-handed 798. Optional 712 for door pairs with astragals. Optional 718 open back strike.
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F/650F series escutcheon trim, 630F/660F/670F series pull/thumbpiece trim, 684F offset pull trim. See pages 27-29.
Dogging:	Hex key dogging supplied standard on panic devices
Options:	Cylinder dogging, shim kit #723, sex nuts and bolts, MicroShield®, Lumi-Lite®
Warranty:	5-year limited

Order as follows, according to function.

7130-K5(F)	(01) Exit only.
	(02) Entry by pull or rigid knob when dogged.
	(03) Key retracts latchbolt. Electrical control for 652F knob trim, w/wo key override.
7130-L5(F)	(02) Entry by rigid lever when dogged.
	(03) Key retracts latchbolt. Electrical control for 652F lever trim, w/wo key override.
	7130-T5(F)
7130-K8(F)	(08) Entry by knob lock/unlocked by key or knob only (passage).
7130-L8(F)	(08) Entry by lever lock/unlocked by key or lever only (passage).
7130-L8(F)-2	(08) Entry by lever lock/unlocked by key either side or lever only (passage).
7130-T8(F)	(05) Entry by thumbpiece lock/unlocked by key or thumbpiece only (passage).



trim designs for escutcheons






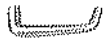
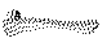




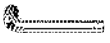
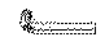





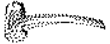





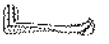
standard

Arcadia AR   Projection: 3-1/4" (82mm)	Augusta AU   Projection: 2-5/8" (61mm)	Carmel CR   Projection: 3-1/8" (79mm)	Jefferson JN   Projection: 2-9/16" (65mm)
Monroe MO   Projection: 3" (76mm)	Pacific Beach PB   Projection: 3-5/16" (84mm)	Pinehurst PN   Projection: 3-1/16" (78mm)	Virginia VI   Projection: 3-1/8" (79mm)
Hampton HA   Projection: 3-3/8" (86mm)	Copenhagen CO  Projection: 3-1/2" (90mm)	Litchfield LF  Projection: 2-7/8" (73mm)	

Note: Projection dimensions are provided using the 620F series escutcheon plates.

Reflections®



	TB	UB	TC	UC					
Hudson									
Projection	3-1/16" (78mm)	3-1/4" (83mm)	3" (76mm)	3-7/16" (87mm)					
	TE	TI							
Danube									
Projection	3" (76mm)	3-3/8" (85mm)							
	TG	TO	TJ	TK					
Seine									
Projection	2-13/16" (71mm)	3-1/2" (89mm)	3-1/16" (78mm)	3-1/4" (83mm)					
	TM	TN	TP	TR	TS	TQ			
Thames									
Projection	3-1/16" (78mm)	3-1/16" (78mm)	3-5/16" (84mm)	3-1/16" (78mm)	3-1/8" (80mm)	3-1/16" (78mm)			
	TT	TU	TV	TW	UW	TX	UX	TU	TZ
Victoria									
Projection	2-11/16" (68mm)	3-1/4" (83mm)	3-1/2" (89mm)	3" (76mm)	3-7/16" (87mm)	3-5/8" (92mm)	3-7/16" (87mm)	3-5/16" (84mm)	3-7/16" (87mm)

Note: Projection dimensions are provided using the 620F series escutcheon plates.

7100 series trims

620F and 650F series escutcheon trim

- Certified ANSI/BHMA A156.3, Grade 1. **BHMA CERTIFIED**
- Trim through-bolts to exit device for strength.
- Beveled sides improve attack resistance.
- Solid forged escutcheon and Free-Wheeling trim resists vandalism and abuse.
- Flush cylinder in 6-pin applications for additional security.
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- Dimensions: 3" x 10-1/4" x 13/16" (76mm x 260mm x 19mm).
- Cylinders not included. See page 42 & 44 for cylinder options. 1-1/2" mortise cylinder required for mortise trim.
- Available with AR, AU, CR, JN, MO, PB, PN, VI, HA lever designs and CO, LF knob designs. See page 26.
 - Finishes: 605, 606, 609, 611, 612, 613, 613E, 616, 619, 620, 626, 629, 630, 693, 722
- Available with Reflections® lever designs. See page 26.
 - Finishes: 605, 606, 611, 612, 613, 613E, 619, 626, 629, 630, 722
- Trim ordering example: AU626F x 626 x RHR.
- 5-year limited warranty.

Application	Cylinder	Classroom/ Storeroom Cylinder Controls Thumbturn	Exit Only Blank Plate	Nightlatch Access by Key	Classroom/ Storeroom Cylinder Controls Knob	Nightlatch Cylinder by Knob	Passage Active Knob	Dummy Trim Rigid Knob	Classroom Cylinder Controls Lever	Storeroom Cylinder Controls Lever	Nightlatch Cylinder by Lever	Passage	Dummy Trim Free-Wheeling	Dummy Rigid Lever
7100(F) 7150(F) 7110(F) 7120(F) 7160(F) 7170(F)	Rim	603F ¹	620F	621F ²	622F ¹	623F ²	624F	625F	626F	626F ¹	627F ²	628F	628F ¹	629F
7130(F)	Mortise	—	620F	651F	652F ³	652F	654F	654F	656F	—	656F	658F	—	658F
7100(F)-2 7150(F)-2	Rim x Rim	—	—	—	—	—	—	—	626F	—	—	—	—	—
7130(F)-2	Mortise x Rim	—	—	—	—	—	—	—	656F	—	—	—	—	—
ANSI		11/12	01	03	08/09	03	14	02	08	09	03	14	02	02

¹ 09, 12 and Free Wheeling 02 achieved with single trim modification at installation.

² Not recommended for use with vertical rod devices.

³ 08 only

For 626, 629 & 630 finishes the escutcheon is plated to simulate stainless steel.

For 629 & 630 finishes the standard levers are plated to simulate stainless steel.

Free-Wheeling is not available on mortise trim.

For 620F series trim, optional door thickness available up to 4-1/2", specify on order.



7100 series trims

630F, 660F and 670F series pull/thumbpiece trim

- Certified ANSI/BHMA A156.3, Grade 1. **BHMA** certified
- Trim through-bolts to exit device for strength.
- Beveled sides improve attack resistance.
- Solid forged escutcheon resists vandalism and abuse.
- Flush cylinder in 6-pin applications for additional security.
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- Plate Dimensions: 2-3/4" x 15-1/2" x 5/8" (70mm x 394mm x 16mm).
- Pull Dimensions: 6-7/16" (164mm) on centers x 2-1/8" (54mm) projection.
- Cylinders not included. See page 42 & 44 for cylinder options. 1-1/2" mortise cylinder required for mortise trim.
- Finishes: 605, 606, 609, 612, 613, 613E, 616, 619, 620, 626, 629, 630, 693, 722
- Trim ordering example: 630F x 630
- 5-year limited warranty.

Applications	Cylinder	Exit Only Blank Plate	Nightlatch Access by Key	Nightlatch Cylinder by Pull	Classroom Cylinder Controls T-Piece	Storeroom Cylinder Controls T-Piece	Dummy Trim Pull Plate	Passage Active T-Piece
7100(F) 7150(F) 7110(F) 7120(F) 7160(F) 7170(F)	Rim	630F	631F ²	632F ²	633F	633F ¹	634F	635F
7100(F)-2 7150(F)-2	Rim x Rim	—	—	—	633F	—	—	—
7130(F)	Mortise	630F K5F	661F K5F	662F K5F	673F T8F	—	634F K5F	675F T8F
7130(F)-2	Mortise x Mortise	—	—	—	—	—	—	—
ANSI		01	03	03	05	06	02	15

- ¹ **06 achieved with single trim modification at installation.**
² **Not recommended for use with vertical rod exit devices.**
For 630F series trim, optional door thickness available up to 4-1/2", specify on order.

For 626, 629 & 630 finishes the escutcheon is plated to simulate stainless steel.

680F series offset pull trim

- 1-3/4" (44mm) door standard. For doors through 2-1/4" (54mm) or shim-mounted devices, specify on order.
- Plate Dimensions: 3" x 10-1/4" x 13/16" (76mm x 260mm x 21mm)
- Pull Dimensions: 7-1/4" (184mm) on centers x 2-13/32" (61mm) projection.
- Trim through-bolts to exit device for strength.
- Beveled sides improve attack resistance.
- Solid forged escutcheon resists vandalism and abuse.
- Flush cylinder in 6-pin applications for additional security.
- Cylinders not included. See page 42 & 44 for cylinder options. 1-1/2" mortise cylinder required for mortise trim.
- Finishes: 605, 606, 609, 611, 612, 613, 613E, 616, 619, 620, 626, 629, 630, 693, 722
- Trim ordering example: 681F x 630 x LHR
- 5-year limited warranty

Applications	Cylinder	Dummy Pull	Nightlatch Access by Key	
7100(F) 7150(F) 7110(F) 7120(F) 7160(F) 7170(F)	Rim	680F	681F*	—
7130(F) 7130(F)-2	Mortise	—	—	684F
ANSI	—	02	03	—

*Not recommended for use with vertical rod exit devices.
 For 626, 629 & 630 finishes the escutcheon is plated to simulate stainless steel.



7000 series | architectural exit devices

7100 series trims

540F series rose trim

- Certified ANSI/BHMA A156.3, Grade 1. **BHMA** CERTIFIED
- 540F rose trim for stock doors.
- Trim through-bolts to exit device for strength.
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- AU, PB and MO trim designs. See below.
- Accepts cylindrical type cylinders. Cylinders included, see page 43 for cylinder options.
- Finishes: 605, 606, 609, 612, 613, 613E, 616, 619, 620, 625, 626, 693, 722
- "B" trim prefix - Lever trim accepting all small format interchangeable cores. 6- or 7-pin (Example: B-AU546F)
- "M" trim prefix - Lever trim accepting Medeco® (32 series) and ASSA® large format interchangeable cores. Available in AU lever only. 6-pin only. (Example: M-AU546F)
- "S" trim prefix - Lever trim accepting Schlage® standard cylinders. 6-pin only. (Example: S-AU546F)
- "SI" trim prefix - Lever trim accepting Schlage® large format interchangeable cores. 6-pin only. (Example: SI-AU546F)
- 3-year limited warranty.

Applications	Nightlatch Access by Key	Classroom Cylinder Controls Lever	Passage Lever	Dummy Trim Free-Wheeling Lever	Dummy Trim Rigid Lever
7100(F), 7150(F), 7110(F), 7120(F), 7160(F), 7170(F)	541F	546F	548F	548F	549F
ANSI	03	08	14	02	02

121NL cylinder only

- Application: 7100(F) and 7150(F) rim and SquareBolt® exit devices. Not recommended for surface or concealed vertical rod devices.
- Must specify rim cylinder when ordering. See page 42 for cylinder options.
- Cylinder collar 1765.250 furnished standard for 1-3/4" thick doors.
- For 1109, 5109, K300, K640, A640 and 2109 cylinders:
 - Screw part number 34-2311-8738-048
 - Backplate part number 34-0010-1015-059
- For 1193, 5193 and K840 cylinders:
 - Screw part number 10-1193-1018-048
 - Backplate part number 34-0010-1015-059

Function Description	Nightlatch Access by Key
Model No.	121NL
ANSI	03

SecureX® electrified options

The Yale® 7000 Series exit devices offer a complete range of electrical options. A continuity in appearance, security and functions with the 7000 Series mechanical exit device is maintained. These electrified exit devices may be integrated into the monitoring security and alarm systems of most buildings.

electrified options

Model #	Exit Device Description	A	B	D	G	H	O	P	S	SAFE	SECURE	690F	691F
7100(F)	Rim Device (Wide)	x	x	x	x	x	x	x	x			x	x
7110(F)	Surface Vertical Rod (Wide)	x	x	x	x			x	x			x	x
7120(F)	Concealed Vertical Rod (Wide)	x	x	x	x			x	x			x	x
7130(F)	Mortise Device (Wide)	x	x	x	x			x	x	x	x		
7150(F)	Rim SquareBolt® Device (Wide)	x	x	x	x	x		x	x	x		x	x
7150(F)WS	Rim SquareBolt Windstorm (Wide)	x	x					x	x	x		x	x
7160(F)	Concealed Vertical Rod (Wide)	x	x	x	x			x	x	x		x	x
7170(F)	Surface Vertical Rod (Wide)	x	x	x	x			x	x	x		x	x
7170(F)WS	Surface Vertical Rod Windstorm (Wide)	x	x					x	x	x		x	x
7200(M)(F)	Rim Device (Narrow)	x	x	x	x				x	x			
7210(M)(F)	Surface Vertical Rod (Narrow)	x	x	x	x				x	x			
7220(M)(F)	Concealed Vertical Rod (Narrow)	x	x	x	x				x	x			
7250(M)(F)	Rim SquareBolt Device (Narrow)	x	x	x	x				x	x			

electrified hardware option descriptions

A	Alarm Option
B	Touchbar Monitor
D	Delayed Egress
G	Electric Dogging
H*	Security Package (DPS)
O	Trim Monitor Switch

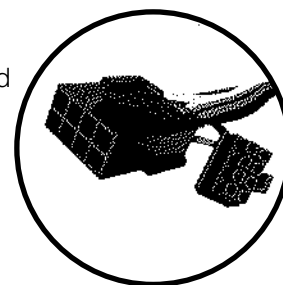
P	Electric Latch Retraction
S	Latchbolt Position Monitor
SAFE	Fail Safe Operation (Mortise)
SECURE	Fail Secure Operation (Mortise)
690F	Fail Safe Electrified Trim
691F	Fail Secure Electrified Trim

Note: Any combination of the following options cannot be ordered together:
 1) P, G, or D 2) B or A 3) D, B or A
 *Only available for rim and SquareBolt® Devices when used with Delayed Egress option.



What normally took an hour or more to connect now takes minutes. Yale electrified exit devices and trims are equipped with ElectroLynx® connectors. As a standard feature, these “plug & play” connectors link power from the incoming source to electrified locking products, including hinges, locks, exit devices, magnetic holders and strikes.

Note: Electrified door hardware with ElectroLynx® connectors require a compatible number of lead wires attached to the door hinge.



SecureX[®] electrified options

electric latch retraction “P”

Operation

Allows the latchbolt to be retracted electrically for momentary or maintained periods of time from a remote location. The exit device bolt remains retracted for as long as the device is energized. Removal of power returns the device to the life safety, self-latching mechanical mode. Easy interface with central or local fire alarm systems, automatic door operators, and access control systems. Allows free egress at all times. Manual hex key dogging standard on non-rated devices.

Electrical Specifications

Solenoid Assembly

- Continuous duty
- 9 amp inrush
- Requires a 4-wire minimum pivot or hinge to transfer power from frame to door.
- Requires the 782 controller for operation (USING ANY OTHER POWER SUPPLY VOIDS THE WARRANTY OF THE DEVICE.)

Listings

UL/cUL listed for panic and fire exit hardware. Fire-rated devices must be wired into an automatic fire alarm system.

Applications

Rim: 7100(F), 7200, 7200M(F)
 SquareBolt[®]: 7150(F), 7250, 7250M(F)
 SVR: 7110(F), 7170(F), 7210, 7210M(F)
 CVR: 7120(F), 7160(F), 7220, 7220M(F)
 Mortise: 7130(F)

Ordering

Suffix “P” to the Model Number. Ex: 7100P.

Note: Not available on “D” delayed egress exit devices.

electric dogging “G”

Operation

Provides continuous latch retraction and pushpad dogging simultaneously. When power is applied to the device, depressing the pushpad will retract the latchbolt and continuously hold down the pushpad in the unlock position for push/pull operation. Removal or interruption of power will release the pushpad and the latchbolt will extend and secure the opening. For use in areas that require quiet door operation.

Exit device allows free egress at all times.

Electrical Specifications

2 Holding Magnets

- .35 amps @ 24VDC

Requires a 2-wire pivot or hinge and a standard 24VDC regulated and filtered power source (Recommended BPS power supplies)

Listings

UL/cUL listed for panic and fire exit hardware. Fire-rated devices must be wired into an automatic fire alarm system.

Applications

Rim: 7100(F), 7200, 7200M(F)
 SquareBolt: 7150(F), 7250, 7250M(F)
 SVR: 7110(F), 7170(F), 7210, 7210M(F)
 CVR: 7120(F), 7160(F), 7220, 7220M(F)
 Mortise: 7130(F)

Ordering

Suffix “G” to the Model Number. Ex: 7150G.

Note: Not available on “D” delayed egress exit devices.

mortise device trim control “safe/secure”

Operation

Allows the outside trim to lock or unlock electrically from a remote location. Exit device allows free egress at all times.

Fail Safe devices are commonly used in stair towers or locations that require the trim to unlock when power is removed or during fire alarm activation.

Fail Secure devices are used to secure openings and are usually integrated into the building security system to allow access control. Fail Secure trims remain locked when power is removed.

Electrical Specifications

Solenoid

- .35 amps @ 24VDC only (12 volt not available)
- Continuous duty
- Requires a 2-wire pivot or hinge and a standard 24VDC regulated and filtered power source (Recommended BPS power supplies)

Listings

UL/cUL listed for panic and fire exit hardware.

Applications

Mortise: 7130(F) - lever functions only

Ordering

“Safe” – Maintains the outside trim in a locked state when energized. Removal of power unlocks outside trim.

“Secure” – Unlocks the outside trim when energized.

Remains locked when power is removed.

Suffix “SAFE” or “SECURE” to the Model Number.

Ex: 7130 x L5 x Safe.

SecureX® electrified options

delayed egress “D”

Operation

An exit door is normally closed and latched. The delayed egress device secures the door in the locked mode with the Red LED indicating locked mode status. Depressing the pushpad for less than three seconds will cause the device to beep without initiating the alarm. Depressing the pushpad for three seconds or longer will initiate an irreversible local audible beeping tone and a visual amber indicator. The person depressing the pushpad is denied egress for 15 or 30 seconds while alarm signals unauthorized egress. After the factory-set delay time (15 or 30 seconds), the device releases for egress, the LED changes to Green and the beep changes to a steady tone which continues to alarm until reset. The remote monitoring contact outputs can be used to alert security personnel.

Note: The 15-second time delay is standard. (Optional 30-seconds may be accepted by local jurisdiction.)

Electrical Specifications

- Input Voltage 24VDC (+/- 10%)
Power Consumption:
- Standard Device: 500 mA
- Device with Security Package: 750 mA
- Device with Electric Mortise Trim Control: 1.25 Amps

Certifications & Listings

UL/cUL Listed: FUKD/FUKD7 - Controlled Exit Panic Devices
FWAX/FWAX7 - Special Locking Arrangements
GXHX/GXHX7 - Fire Exit Hardware
ANSI/BHMA Certified: A156.3 & A156.24 
U.S. Patent #: 7,469,942

Applications

- For use on hollow metal interior or exterior doors.
- Available for 7100(F), 7200M(F) and 7200 series rim, SquareBolt®, surface vertical rod, concealed vertical rod and mortise panic and



fire-rated exit devices. For surface vertical rod exit devices, rod and latch guards (provided by other) must be used.

- Complies with NFPA 101 “Code For Safety To Life From Buildings And Structures” by National Fire Protection Association.
- BOCA options available to comply with National Building Code requirements. BOCA option is not suitable for installations in accordance with NFPA 101.
- 1-3/4" door thickness standard; 2" and 2-1/4" optional; specify when ordering.
- Standard 36" device fits doors 35"- 36" Device cannot be cut less than 35".
- Option -48 fits doors 41"- 48". Devices cannot be cut less than 41".

Standard Features

Key Switch Operation:

- Normal: The system is armed by applying power to the device (solid Red LED). Depressing the pushpad for more than the nuisance delay time starts the exit delay cycle.
- Bypass: Turning the key switch clockwise to the bypass position allows immediate egress without alarming. The bar functions as a standard exit device (Red LED flashes slowly).
- Reset/Delay: Used to reset device after the factory-set 15 or 30-second delay cycle has timed out. Rearm: If the device is armed, turning the key counterclockwise to the reset mode will release the device without alarm for egress and will rearm after 10 seconds (Red LED flashes quickly).

Local Visual Status Indicator:

- RED: The exit device is secure and the delayed egress circuitry is energized.

- AMBER: The egress cycle has started, indicated by an irreversible local audible beeping tone.
- GREEN: The exit device is in alarm and has released.

Nuisance Delay Time:

- Depressing the pushpad for less than three seconds sounds an audible beep without activating the irreversible alarm sequence. (Immediate alarm can be selected by removing a jumper on the control board.)

Internal Alarm Siren:

- When armed, depressing the pushpad initiates the internal 85db alarm siren.

Remote Control Inputs:

- Remote Reset: Accepts a momentary contact (keyswitch, pushbutton, etc) to reset the unit during alarm or allows momentary egress (10 seconds) when the unit is armed.
- Remote Bypass: Accepts a momentary contact to put the unit in a maintained bypass operation. The exit device functions as a standard device.

Alarm Outputs:

- Two sets of normally open and normally closed contacts. Contacts change only during alarm status. One set of contacts changes when device delay cycle has started (Alarm). One set of contacts changes when device has released (Secure).

Door Sign:

- Door sign per code included.

SecureX® electrified options

delayed egress “D”

Options

Security Package “H”:

- An internal door position switch that gives added security to the opening and is recommended. When using this option the alarm will sound if the door is not closed and latched when arming the device or if the door is forced open when the device is armed.
- To order, suffix “H”.
- NOTE: Available for 7100(F) Rim and 7150(F) SquareBolt® devices only.

Latchbolt Position Monitor “S”:

- Used to monitor the positions of the latchbolt or vertical rods (SPDT switch).
- To order, suffix “S”.
- See page 37 for more information.

Trim Monitor Switch “O”:

- Used when outside trim is desired. This switch will allow Bypass (disarms device) when the trim is used for ingress. The device will need to be reset upon entry by means of the keyswitch on the device or a remote switch.
- To order, suffix “O”.
- NOTE: If the security package or external DPS is not used, standard trim will allow entry without affecting the device in an armed mode. The device will only be affected when the pushpad is depressed.
- See page 37 for more information.

NFPA 101 Requirements:

- 15- & 30-Second Delay
- Upon depressing the pushpad for 3 seconds, the delayed egress device will sound an audible beeping tone and allow the door to be opened after 15 (or 30) seconds. The tone will then change to a continuous alarm until reset. Resetting of the alarm and re-arming of the device is accomplished by manual means only.
- To order, specify NFPA 15-second

or NFPA 30-second.

- Purchase orders that do not have an option noted will default to the NFPA 15-second delay.
- NOTE: Where approved by the authority having jurisdiction, a delay not exceeding 30 seconds shall be permitted.

BOCA Requirements:

- 15- & 30-Second Delay
- Upon depressing the pushpad for 1 second, the delayed egress device will sound an audible beeping tone and allow the door to be opened within 15 (or 30) seconds. The tone will then change to a continuous alarm until reset. Resetting of the alarm and re-arming of the device occurs automatically once the door has been returned to the closed position for 30 seconds. The 30-second re-arming timer will re-start if the pushpad is depressed or the door is re-opened before actual re-arming of the device occurs. A DPS (Door Position Switch) is required for the BOCA option.
- To order specify BOCA 15-second or BOCA 30-second.
- Purchase orders that do not have an option noted will default to the NFPA 15-second delay.
- NOTE: An increase in the egress delay to 30 seconds shall not be permitted except as approved by the authority having jurisdiction.

Electric Trim Control - “SAFE” or “SECURE”:

- The mortise delayed egress exit device can be ordered with fail safe or fail secure outside trim operation. In a fire condition the fail safe trim will release for entry. When access control is used the fail secure trim allows entry by means of a remote card reader, keyswitch, pushbutton, etc.
- To order, suffix “Safe” or “Secure”.

- NOTE: The trim will open the door without affecting the device in an armed condition, if a door position switch is not used.

required accessories

Power Supply:

A regulated and filtered power supply with a fire alarm interface is required. 1 Amp minimum @ 24VDC per device. Special options will require more amperage. Consult factory. Recommend: BPS series.

Power Transfer:

Allows the power cable to make the transition from frame to door without pinching or removal of insulation.

Cylinders

Utilizes a 1-1/8" mortise cylinder with a 2160 cam. Cylinder not included unless specified. See page 44 & 45.

Ordering

Suffix “D” after device.
Example: 7150FD

alarm kit & electric trim

alarm kit "A"



Activation: Alarm is armed by turning key clockwise. Low audible chirp indicates alarm has been activated. Alarm will sound when the exit device pushpad is depressed. Factory preset for standard alarm mode which automatically resets after 5 minutes.

Continuous Alarm Mode: Alarm sounds continuous when the exit device pushpad is depressed. Alarm must be manually reset by keyswitch. (This feature is selected by a switch on the circuit board.)

Low Battery Warning: Audible chirp.

Nuisance Alarm: Factory preset for instant alarm. Selectable feature for alarm to sound when pushpad is depressed for more than 2 seconds. (This feature is selected by a switch on the circuit board.)

Arming Delay/Authorized Egress: 10-second delay (after arming) permitting egress (by turning key clockwise).

Alarm Shunt: Ingress shunt alarm input for devices with latchbolt position (S) monitor. NOTE: "S" included with SVR devices.

Power Requirements: One 9-Volt Battery (included).

Loudness: 90db @ 10 feet.

Arm/Disarm: Uses one 1-1/8" straight cam mortise cylinder. Clockwise turn arms the alarm, counter clockwise turn disarms or silences the alarm.

Device Status: A Red LED indicator will illuminate every 30 seconds when the alarm is armed.

Tamper Resistant: Built-in safety monitor sounds alarm when tampering occurs.

Warning Decal: "EMERGENCY EXIT - ALARM WILL SOUND"

Applications: Rim: 7100(F), 7200, 7200M(F); SquareBolt®: 7150(F), 7250, 7250M(F); SVR: 7110(F), 7170(F), 7210, 7210M(F); CVR: 7120(F), 7160(F), 7220, 7220M(F); Mortise: 7130(F)

Kit: Available in kit form for field retrofit.

Bar Length: Available for 36"- 48" devices only. May not be used on bars less than 36".

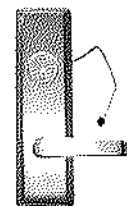
- Standard 36" device fits doors 35"-36" Device cannot be cut less than 35".
- Option -48 fits doors 41"- 48". Devices cannot be cut less than 41".

How to Order: Specify 7116 for alarm kit. Suffix "-A" when ordering with device. Ex: 7150-A.

NOTE: The 7116 alarm kit cannot be retrofitted in the field to the 7110(F), 7170(F), 7210 or 7210M(F) surface vertical rod exit devices. This option is available as a factory order only for these devices. Any attempt to retrofit the 7116 alarm kit with these surface vertical rod exit devices will void the warranties for these products.

electric trim

The electrified 600 series heavy-duty trim provides electric locking and unlocking of trim. Ideal for door control where increased security is necessary at all times, while meeting life safety codes. Electric trim is ideal for many applications, including stairwell towers, high-security areas, schools, hospitals, and factories.



Functions

690F Trim - Fail Safe

- Lever is locked when power is on (Free-Wheeling)
- Power off allows entry from trim
- Inside device is always active for egress
- Mechanical key override (09 Function - Key allows lever to retract latchbolt. Key can only be removed in locked position)

691F Trim - Fail Secure

- Lever is locked when power is off (Free-Wheeling)
- Power on allows lever activation for entry
- Inside device is always active for egress
- Mechanical key override (09 Function - Key allows lever to retract latchbolt. Key can only be removed in locked position.)

Features

- Accepts all standard and Reflections® decorative lever designs
- Plug connector with 4' wire lead (Exit device is used as wire raceway, not door)
- Key Override - Requires rim cylinder (sold separately)

Applications

- 7100(F) Rim Device
- 7150(F) SquareBolt®
- 7110(F), 7170(F) Surface Vertical Rod

Electrical Specifications

- 330 mA @ 24 Volts
SM - Security Monitor Switch
- 4 AMP @ 250VAC
Voltage: 24 VAC/VDC only
BPS series power supplies recommended.

Options

- SM - Security Monitor. A SPDT switch that monitors the position of the solenoid (lock and unlock status).
- EX - Trim gasket for exterior applications.

monitors and signal switches

touchbar monitor "B"

Provides indication of the pushpad being depressed. Used as a Request to Exit switch to shunt alarm systems, release electromagnetic locks or monitor egress.

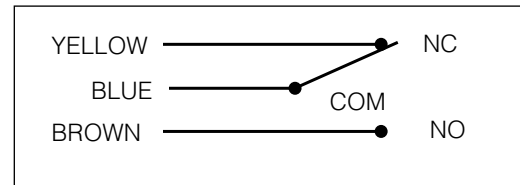
Electrical Specifications: 4 Amps @ 250VAC contacts

Listings: UL/cUL listed for panic and fire exit hardware.

Applications: Rim: 7100(F), 7200, 7200M(F)
 SquareBolt®: 7150(F), 7250, 7250M(F)
 SVR: 7110(F), 7170(F), 7210, 7210M(F)
 CVR: 7120(F), 7160(F), 7220, 7220M(F)
 Mortise: 7130(F)

Ordering: Suffix "B" to the Model Number. Ex: 7120B.

Note: Not available on "D" Delayed Egress devices or with the "A" Alarm kit option.



latchbolt position monitor "S"

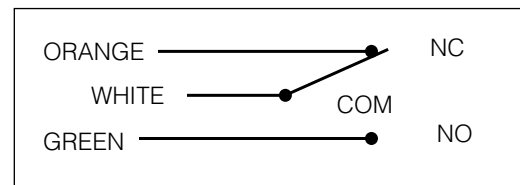
Provides indication on the position of the latchbolt. Used with security systems to monitor the latchbolt, also used to activate automatic door operators upon latch retractions.

Electrical Specifications: SPDT contacts rated 5 amp @ 28VDC

Listings: UL/cUL listed for panic and fire exit hardware.

Applications: Rim: 7100(F), 7200, 7200M(F)
 SquareBolt®: 7150(F), 7250, 7250M(F)
 SVR: 7110(F), 7170(F), 7210, 7210M(F)
 CVR: 7120(F), 7160(F), 7220, 7220M(F)
 Mortise: 7130(F)

Ordering: Suffix "S" to the Model Number. Ex: 7120S.



trim monitor switch "O"

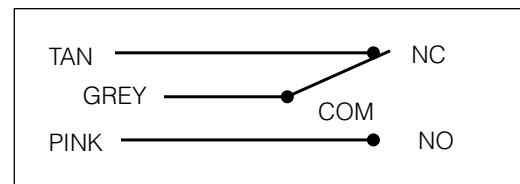
Provides indication of the trim being operated from the outside. Used as a Request to Enter signal switch to shunt alarms, also used to monitor entry.

Electrical Specifications: SPDT contacts rated 5 amp @ 28VDC

Listings: UL/cUL listed for panic and fire exit hardware.

Applications: Rim: 7100(F)
 SquareBolt®: 7150(F)
 SVR: 7110(F), 7170(F)
 CVR: 7120(F), 7160(F)
 Mortise: 7130(F)

Ordering: Suffix "O" to the Model Number. Ex: 7150O.



stand-alone door alarm

The SDA16 stand-alone battery operated door alarm is designed to continually monitor the status of a door. When the door is opened without authorization, an alarm is triggered to alert the security violation. This alarm features a Peizo horn which blasts a deafening 105+ decibels to alert the violation.

This unit is ideal for emergency doors as well as stairwell doors and rear exit doors in retail environments. The unit, which can also be hardwired, easily complements existing hardware, making any opening alarmed. The SDA16 door alarm is typically mounted on the interior of the door frame or door and is paired with a magnet mounted on the opposing side of the door gap.

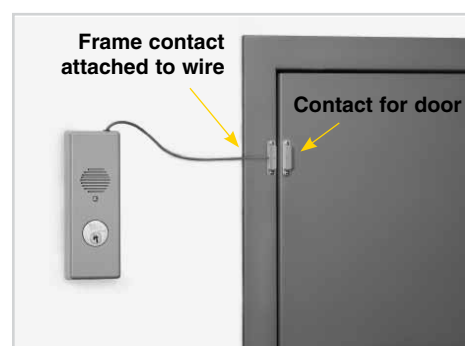


features

- Dimensions: 8.3"L x 3.1"W x 2.0"D (210mm L x 79mm W x 52mm D)
- Non-handed unit (field reversible)
- Unit powered by 9V battery
- Unit can be hardwired by using WH-11 wire harness and 784 power supply
- No battery is required in unit with hard-wire option – if power is lost, optional gel-cell battery in power supply will give approximately 10,000 operations
- Reverse battery protection safeguards the unit if the battery is incorrectly installed
- A low-voltage battery is indicated by an audible signal every 30 seconds
- Piezo horn blasts at 105+ decibels if the door is used with out proper authorization
- The LED will flash every 30 seconds, indicating either the unit is armed or, if under auto reset, that the door has been violated
- Various field-adjustable features by dip switch including automatic alarm reset, REX and passage time delay, and LED color preference
- A tamper switch provides instantaneous signal to sound horn in the event the cover is removed. Horn will sound until the unit is reset by the key or remote reset/arm switch
- Conformally coated electronics for weather resistance
- Cover is held in place by cam lock which protects mounting screws, electrical system and internal sensors
- Accepts external cylinder (not included, must be specified)
- Accepts standard mortise cylinders (not included, must be specified)

remote mounting

The SDA16 can be installed remotely from the door by attaching the contacts to the door and frame. The unit can be installed up to 6 feet from the door. This provides the ideal solution for circumstances where exposure to weather may be an issue. To order specify "SDA16XL".



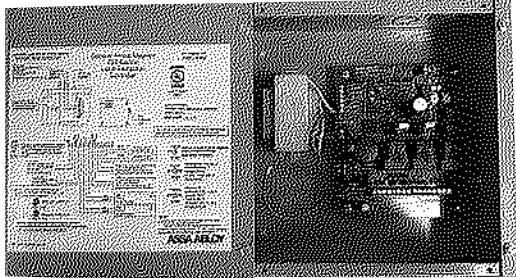
Note: Actual wire length is 6 feet.

cylinders and accessories

- 784 Power supply (9VDC) — includes plug-in wall transformer
- Plug-in wall transformer with 12' cable assembly (part no. 00-0000-3425)
- Gel-cell battery — optional for use with 784 power supply (part no. 00-0000-3426)
- WH-11 Wire harness for remote power and remote unlock
- Mortise cylinder for unit
- Rim cylinder for outside control
- See pages 42 & 45 for cylinder information.

SecureX® accessories

782 power control



Operation

Designed to control one or two electric latch retraction “P” exit devices. Equipped with two 20-second timers which can operate the exit devices together or independently. Requires a momentary or timed, dry contact input and can be interfaced with access control systems, automatic door operators, “blow open” type scenarios and has provisions for N/C fire alarm systems.

Note: The 782 is required for use with the “P” latch retraction option. Using any other power supply with the “P” option voids the warranty of the device.

Features

- Two control inputs. Accepts normally closed dry contacts for device activation from a key switch, push button, access control or fire alarm system.
- Two normally open control outputs for automatic door operators
- Two “P” device outputs
- Fire Alarm Interface input
- 24VDC output for audible or LEDS .25 AMP

Electrical Specifications

- 120 VAC 60Hz 750mA (max.)
- 10 amp inrush

Listings

- UL 294
- UL CLASS 2 outputs

Applications

“P” Electric Latch Retraction Option

Ordering

782 Controller

bps power supplies by securitron®

Operation

Power supplies are designed to provide reliable filtered and regulated power for long life to a variety of electrified hardware components.

Product Features

- Individual output circuit breakers
- Regulated and filtered fuse protected outputs
- LEDs monitor zone status (voltage or no voltage)
- Slide switches connect or disconnect load from power (Not available on 1 Amp supplies)
- Internal Back-Up battery charging circuit
- Rugged steel enclosure
- Fire alarm interface

Listings

- UL CLASS 2

Applications (use with):

- D – Delayed Egress
- G – Electric Dogging
- Safe – Fail Safe mortise device trim control
- Secure – Fail Secure mortise device trim control
- 690/691 – Electric Trim

Ordering

Ex: BPS-24-4

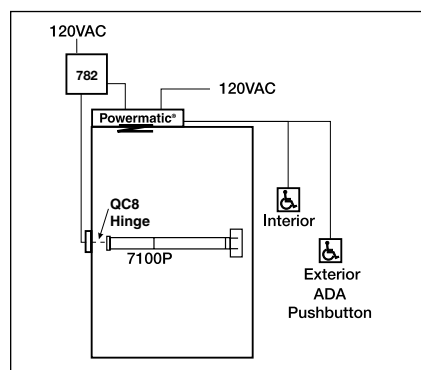
Model	Input	Output	Application
BPS-24-1	120 VAC	1 Amp @ 24 VDC	1 “D”
BPS-24-2	120 VAC	2 Amp @ 24 VDC	2 “D” or 1 “D” with Safe or Secure
BPS-24-4	120 VAC	4 Amp @ 24 VDC	4 “D” or 3 “D” with Safe or Secure

Consult factory for additional power supply applications.

electrified system guide

latch pullback

Electric Latch Pullback Interfaced with an Automatic Door Operator



Components

- 7100P Latch Retraction
- 782 Controller
- PowerMatic® Door Operator by Norton®
- ADA Pushbuttons #661 by Norton
- QC8 Power Transfer Hinge by McKinney®

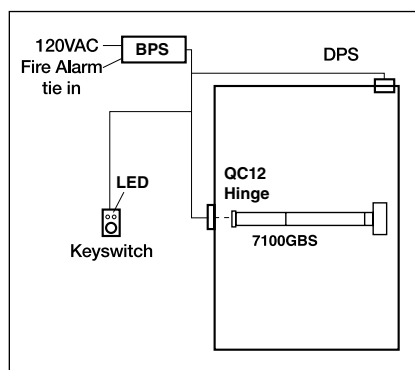
Operation

Exit device allows free egress at all times.

Activating the interior or exterior pushbutton retracts the latchbolt in the device and the door automatically opens. Door closes and relatches after hold open time has elapsed in the operator.

electric dogging

Electric Dogging with Monitor Functions



Components

- 7100GBS Electric Dogging Device with Touchbar Monitor
- BPS Power Supply with fire alarm interface
- Keyswitch with a Red and a Green LED
- DPS (door position switch) by Securitron®
- QC12 Power Transfer Hinge by McKinney®

Operation

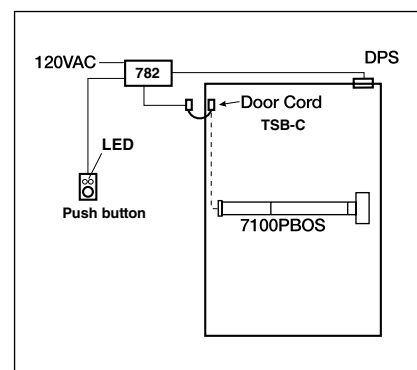
Exit device allows free egress at all times.

Activating the maintained keyswitch applies power to the 7100GBS device. The first mechanical depression of the pushpad will retract the latchbolt and hold the pushpad down in a dogged position. Fire alarm activation, interruption of power or turning the keyswitch off will release the pushpad and the latch will extend.

- The Green LED illuminates when power is on, and the pushpad can be depressed and dogged.
- The Red LED illuminates when power is off, the door is closed and the device is latched and secure.

monitor functions

Electric Latch Retraction with Monitor Functions



Components

- 7100PBOS, Exit Device with Touchbar, Outside Trim and Bolt Position Monitors
- 782 Controller
- Momentary Pushbutton with Red and Green LED
- DPS (door position switch) by Securitron®
- TSB-C Door Cord by Securitron®

Operation

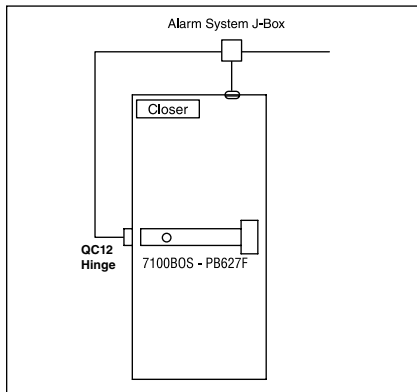
Exit device allows free egress at all times.

Activating the 402 x L2 push button retracts the latchbolt from a remote location.

- The Red LED indicates that the door is closed and latched.
- The Green LED illuminates when any of the following situations occur:
 - The pushpad is depressed
 - Tampering or retraction of the latchbolt
 - Operation of outside trim
 - Opening of door

electrified system guide

monitor functions
Rim Exit Device
with High Security Application



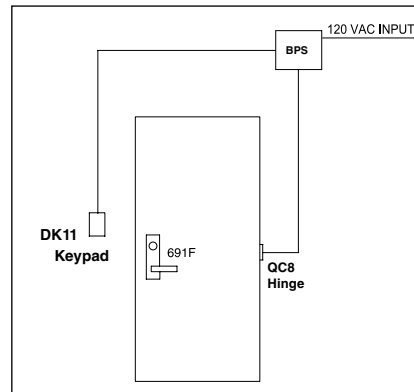
Components

- 7100 - PB627F Nightlatch Trim - Yale®
- S Bolt Position Monitor Switch
- B Pushpad Monitor Switch
- O Trim Monitor Switch
- Door Position Switch - Securitron®
- QC12 Power Transfer Hinge by McKinney®
- Surface Door Closer - Yale

Operation

Operation of the 7100 Exit Device with the S, B, O and ASSW-104A can be used together or individually to sound an alarm, shunt an alarm, monitor the door's security or as a "Request to Exit" in conjunction a magnetic lock.

electric trim
Rim Exit Device with Electrified Trim



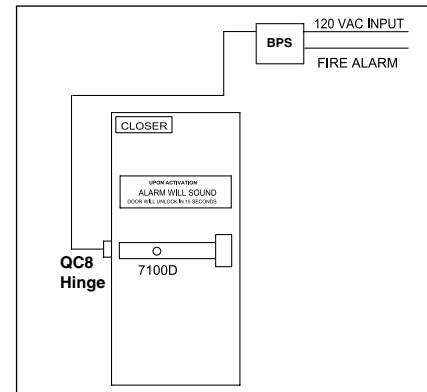
Components

- 691F Electrified Trim - Yale
- 7100 Rim Exit Device - Yale
- Digital Keypad by Securitron®
- QC8 Power Transfer Hinge by McKinney®
- BPS Power Supply

Operation

Operation of the Digital Keypad will allow keyless entry from the non-protected side of the opening. When a valid code is entered into the keypad, voltage will be applied to the trim, making the lever active and allowing ingress. Free exit is allowed by using the exit device from the protected side of the door.

delayed egress
Rim Exit Device with Delayed Egress Option on "Exit Only" Door



Components

- 7100D Delayed Egress Exit Device - Yale
- QC8 Power Transfer Hinge by McKinney®
- BPS Power Supply
- Surface Door Closer - Yale

Operation

Operation of the 7100D Exit Device will sound an alarm and activate either a 15- or 30-second alarm sequence inside of the exit device. After this time period, the device will release the pushpad, making it active and egress is possible. When the fire alarm is activated, power to the exit device will be interrupted, allowing free egress and mechanical latching. Authorized alarm bypass and reset is done through the built-in keyswitch located in the exit device. An optional High Security package includes a door prop alarm to prevent the door from being blocked open.

cylinders

rim

The following chart details rim cylinders for use with 480F, 500F, 510F, 620F, 680F, 630F, 121NL trims and outside of SDA16 door alarm:

Model #	Description	Pins	Length	Collar Requirements*				
				480F/500F/ 510F	620F/680F	630F	121NL	SDA16 Outside
1109	Standard Fixed Core	6	1-1/4"	599.419	No Collar	No Collar	1765.250	1765.250
1109	Standard Fixed Core	7	1-7/16"			KP4		
1709	CMK	6	1-15/16"	599.544	1765.250	1765.250	1765.250	1765.250
1709	CMK	7	1-5/8"			1765.406		
1193	LFIC Complete	6	1-7/16"	599.544	1765.344	1765.250	1765.250	1765.250
1193	LFIC Complete	7	1-5/8"	599.700		1765.406		
5109	Security Fixed Core	6	1-9/16"	599.419	No Collar	1765.250	1765.250	1765.250
5109	Security Fixed Core	7	1-7/16"					
U5109	High Security Fixed Core	6	1"	NA	No Collar	No Collar	No Collar	No Collar
U5109	High Security Fixed Core	7	1"					
5193	Security LFIC Complete	6	1-7/16"	599.544	1765.250	1765.250	1765.250	1765.250
5193	Security LFIC Complete	7	1-5/8"	599.700	1765.344	1765.406		
K300	Yale® KeyMark® Standard Fixed Core	6	1-1/8"	599.544	KP4	1765.250	1765.250	1765.250
K300	Yale KeyMark Standard Fixed Core	7						
K840/ K880	Yale KeyMark LFIC Complete / Housing Only	6	1-7/16"	599.700	1765.406	1765.500	1765.250	1765.250
K840/ K880	Yale KeyMark LFIC Complete / Housing Only	7	1-5/8"	NA	1765.563	1765.719		
K640/ K680	Yale KeyMark SFIC Complete / Housing Only	6	1-1/4"	599.544	KP4	1765.250	1765.250	1765.250
K640/ K680	Yale KeyMark SFIC Complete / Housing Only	6 or 7	1-3/8"	599.700	1765.187	1765.406		
A640/ K680	Best® Keyway SFIC Complete / Housing Only	6	1-1/4"	599.544	KP4	1765.250	1765.250	1765.250
A640/ K680	Best® Keyway SFIC Complete / Housing Only	6 or 7	1-3/8"	599.700	1765.187	1765.406		
2109	Schlage® "C" Keyway Fixed Core Available 0-bitted or keyed random.	6	1-1/8"	599.419	No Collar	No Collar	1765.250	1765.250

*Based on 1-3/4" door thickness. Collar length required must be specified for cylinders and/or housings ordered separately.

LFIC = Large Format Interchangeable Core

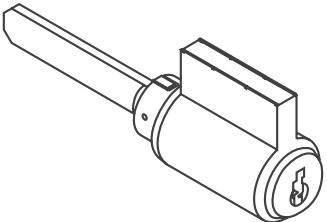
SFIC = Small Format Interchangeable Core

NA = Application Not Available

cylinders

component

The following chart details component cylinders for use with 540F series trim.

	Model #	Description	Pins
	1802	Standard Lever Fixed Core	6
	1802A	Standard Lever Fixed Core	7
	5802A	Security Lever Fixed Core	7
	1210	LFIC Only	6
	1220	LFIC Only	7
	5210	Security LFIC Only	6
	5220	Security LFIC Only	7
	K402	Yale KeyMark Lever Fixed Core	6 or 7
	K800	Yale KeyMark LFIC Only	6 or 7
	K600	Yale KeyMark SFIC Only	6 or 7
	A600	Best® Keyway SFIC Only	6 or 7
	2802	Schlage® "C" Keyway Fixed Core. Available 0-bitted or keyed random.	6
	3804*	Corbin Russwin "L4", Corbin "60", Russwin "D1", Sargent® "LA" or Schlage® "E" Keyway Fixed Core. Specify keyway. Available keyed random	6

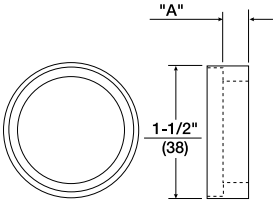

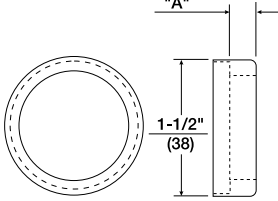
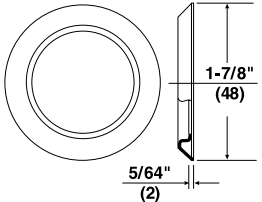
*Requires the 107S kit. These cylinders are not ANSI/BHMA certified.

mortise

Please see page 44-45 for the detailed charts of mortise cylinders.

cylinder collars

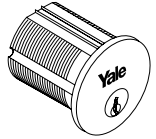
If required, cylinder collar size must be specified.

			
<p>1765 Recessed Cylinder Collar "A" Dimension: Thicknesses from 1/16" (2mm) to 1-15/32" (37mm) as required. Material: Brass, Bronze</p>	<p>KP3 Wave Washer (Furnished standard with 1765 collar for Yale® KeyMark® cylinders and 630F series trim).</p>	<p>599 Recessed Cylinder Collar with Radius "A" Dimension: Thicknesses from 1/16" (2mm) to 1-15/32" (37mm) as required. Material: Brass, Bronze</p>	<p>KP4 Flush Mount Cylinder Collar Material: Brass, Bronze</p>

cylinders

mortise

The following chart details mortise cylinders for use with 350F, 650F, 660F, 670F trims, cylinder dogging, delayed egress, and 7116 alarms:



Model #	Description	Pins	Length	350F/650F		660F/670F		Cylinder Dogging/ Delayed Egress/7116 Alarm	
				Cam	Collar	Cam	Collar	Cam	Collar
2153	Standard Fixed Core	6	1-1/8"	2160	NA	2160	NA	2160	No Collar
2153	Standard Fixed Core	6	1-1/2"		No Collar		KP4		NA
2153	Standard Fixed Core	7	1-1/4"		NA		NA		1765.156
2153	Standard Fixed Core	7	1-1/2"		No Collar		KP4		NA
2196	LFIC Complete	6	1-1/2"		KP4		1765.250		1765.406
2197	LFIC Complete	7	1-11/16"		KP4		1765.250		1765.594
5153	Security Fixed Core	6	1-1/8"		NA		NA		No Collar
5153	Security Fixed Core	6	1-1/2"		No Collar		KP4		NA
5153	Security Fixed Core	7	1-1/4"		NA		NA		1765.156
5153	Security Fixed Core	7	1-1/2"		No Collar		KP4		NA
U5153	High Security Fixed Core	6	1-1/8"		NA		NA		
U5153	High Security Fixed Core	7	1-1/4"		NA		NA		NA
5196	Security LFIC Complete	6	1-1/2"		No Collar		KP4		1765.406
5197	Security LFIC Complete	7	1-11/16"		KP4		1765.250		1765.594
K100	Yale® KeyMark® Standard Fixed Core	6 or 7	1-1/8"	KC1	NA	KC1	NA	KC1	No Collar
K100	Yale KeyMark Standard Fixed Core	6 or 7	1-1/2"		No Collar		KP4		NA
K100	Yale KeyMark Standard Fixed Core	6 or 7	1-3/4"	Riveted	KP4	Riveted	1765.375	NA	NA
K820/ K860	Yale KeyMark LFIC Complete / Housing Only	6	1-1/2"	KC1	No Collar	KC1	KP4	KC1	1765.406
K820/ K860	Yale KeyMark LFIC Complete / Housing Only	7	1-11/16"		KP4		1765.375		1765.594
K620/ K660	Yale KeyMark SFIC Complete / Housing Only	6	1-1/4"		NA		NA		1765.156
K620/ K660	Yale KeyMark SFIC Complete / Housing Only	6 or 7	1-3/8"		No Collar		1765.281		
K620/ K660	Yale KeyMark SFIC Complete / Housing Only	6 or 7	1-3/4"	Riveted	KP4	Riveted	1765.375	NA	NA
A620/ K660	Best® Keyway SFIC Complete / Housing Only	6	1-1/4"	KC1	NA	KC1	NA	KC1	1765.156
A620/ K660	Best® Keyway SFIC Complete / Housing Only	6 or 7	1-3/8"				No Collar		1765.281
A620/ K660	Best® Keyway SFIC Complete / Housing Only	6 or 7	1-3/4"	Riveted	KP4	Riveted	1765.375	NA	NA
2553	Schlage® "C" Keyway Fixed Core. Available 0-bitted or keyed random.	6	1-1/8"	2160	NA	2160	NA	2160	No Collar

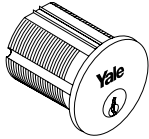

See legend notes on following page.



cylinders

mortise

The following chart details mortise cylinders for use with inside of SDA16 door alarm, KRM200 standard and windstorm mullions

				SDA16 Inside		KRM200 (Standard)		KRM200 (Windstorm)  Hurricane	
				Cam	Collar	Cam	Collar	Cam	Collar
Model #	Description	Pins	Length						
2153	Standard Fixed Core	6	1-1/8"	2160	No Collar	2160	1765.312	2160	1765.156
2153	Standard Fixed Core	7	1-1/4"		No Collar		1765.500		1765.250
2196	LFIC Complete	6	1-1/2"		KP4		1765.750		1765.500
2197	LFIC Complete	7	1-11/16"		1765.250		1765.844		1765.719
5153	Security Fixed Core	6	1-1/8"		No Collar		1765.312		1765.156
5153	Security Fixed Core	7	1-1/4"		No Collar		1765.500		1765.250
U5153	High Security Fixed Core	6	NA		NA		NA		NA
U5153	High Security Fixed Core	7	NA		NA		NA		NA
5196	Security LFIC Complete	6	1-1/2"		KP4		1765.750		1765.500
5197	Security LFIC Complete	7	1-11/16"		1765.250		1765.844		1765.719
K100	Yale® KeyMark® Standard Fixed Core	6 or 7	1-1/8"	KC1	No Collar	KC1	1765.312	KC1	1765.156
K820/ K860	Yale KeyMark LFIC Complete / Housing Only	6	1-1/2"		KP4		1765.750		1765.500
K820/ K860	Yale KeyMark LFIC Complete / Housing Only	7	1-11/16"		1765.250		1765.000		1765.719
K620/ K660	Yale KeyMark SFIC Complete / Housing Only	6	1-1/4"		No Collar		1765.500		1765.250
K620/ K660	Yale KeyMark SFIC Complete / Housing Only	6 or 7	1-3/8"		No Collar		1765.563		1765.500
A620/ K660	Best® Keyway SFIC Complete / Housing Only	6	1-1/4"		No Collar		1765.500		1765.250
A620/ K660	Best® Keyway SFIC Complete / Housing Only	6 or 7	1-3/8"		No Collar		1765.563		1765.500
2553	Schlage® "C" Keyway Fixed Core. Available 0-bitted or keyed random.	6	1-1/8"	2160	No Collar	2160	1765.312	2160	1765.156

Based on 1-3/4" door thickness. Collar length required must be specified for cylinders and/or housings ordered separately.

LFIC = Large Format Interchangeable Core.

SFIC = Small Format Interchangeable Core.

NA = Application Not Available

strikes
rim devices

<p>757F Standard strike for 7100(F), 7150(F), 7200M(F) and 7250M(F) devices. Supplied with #10-24 x 3/4" machine screws, two shims (each 1/16" thick), and one locking plate.</p>	<p>757FWS Standard strike for 7150(F)WS and 7250M(F)WS devices. Supplied with 2 each #10-24 x 1-1/4" and 2 each #10-24 x 3/4" machine screws, two shims (each 1/16" thick), one locking plate and one interlocking bracket (not shown) with 4 each #10-24 x 3/4" machine screws.</p>	<p>759 Standard strike for 720X devices.</p>	<p>793 Optional strike for double door applications without a mullion. Supplied with #10-24 x 3/4" machine screws, two shims (each 1/16" thick), and one locking plate. Panic only.</p>

vertical rod devices - top strikes

<p>791 Standard top strike for 7110(F), 7120(F), 7210, 7220, 7210M(F), 7220M(F) series devices. Supplied with #10-24 x 3/4" machine screws, two shims (each 1/16" thick), and one locking plate.</p>	<p>726 Standard top strike for 7170(F) series devices. Supplied with #12-24 x 11/16" machine screws and #12 x 1-1/4" sheet metal screws, and one shim (1/16" thick).</p>	<p>761 Standard top strike for 7160(F) series devices. Supplied with #10-32 x 3/8" machine screws and #10 x 1" sheet metal screws.</p>	<p>797 Optional bracket for mounting 791 top strike in flush transom opening. Supplied with 1/4-20 machine screws; SN-134 sex nuts, optional.</p>

vertical rod devices - bottom strikes

<p>790 Standard bottom strike for 7110(F), 7120(F), 7160(F), 7170(F), 7210, 7220, 7210M(F), 7220M(F) series devices. Press in place.</p>	<p>794 Optional bottom strike for fire openings using saddle thresholds or for flush floor mount. Must use for fire openings with 1/2" thresholds. Supplied with #10-24 x 1/2" machine screws and floor anchors.</p>	<p>702 Optional bottom strike for bottom pullman latch option. Supplied with #8 x 8/32" combination screws.</p>

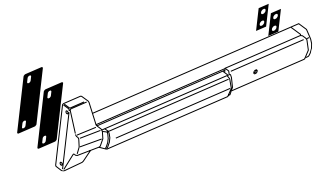
strikes mortise devices

<p>798 Standard curved lip ANSI strike used with 7130(F) devices. (1-1/4" lip)</p>	<p>712 Optional flat lip ANSI strike used with 7130 devices for pairs of doors with astragals. (7/8" lip)</p>	<p>718 Optional open back strike. Permits opening of the inactive door for pairs of doors where approved by door manufacturer.</p>	<p>202 Optional strike box for ANSI strikes. 7/8" (22mm) deep.</p>

accessories/options

shim kits

Shim kits, for devices on doors with interfering molding, are available. Each standard shim kit contains 2 sets of 1/8" thick shims to shim a device 1/8" (3mm) or 1/4" (6mm). Windstorm (WS) shim kits contain 3 sets of 1/8" thick shims. Longer device mounting screws (not included) are required for more than 1/4" (6mm) shimming. 693 (Black) finish.



723	Shim kit for 7100(F) series rim, 7150(F) series Squarebolt®, 7120(F), 7160(F) series* concealed vertical rod, and 7130(F) series* mortise exit devices.
723WS	Shim kit for 7150(F)WS series SquareBolt exit devices.
723NS	Shim kit for 7200 series rim, 7200M(F) series rim, 7250 series Squarebolt, 7250M(F) series Squarebolt, 7220 series* and 7220M(F)* concealed vertical rod exit devices.
723NSWS	Shim kit for 7250M(F)WS series SquareBolt exit devices.
724	Shim kit for 7110(F) and 7170(F) series surface vertical rod exit devices.
724WS	Shim kit for 7170(F)WS series surface vertical rod exit devices.
724NS	Shim kit for 7210(F) series surface vertical rod exit devices.

*Note: Special mortise or concealed vertical rod components needed for openings requiring more than (2) shim kits, or for shimmed mortise devices in doors over 1-3/4" (44mm) thick. Details on application.

extension rods

Model #	Length
7010-2	2" (51mm)
7010-6	6" (152mm)
7010-12	12" (305mm)
7010-24	24" (610mm)

Specify finish.

specialty fasteners

Sex Nuts:

Required for wood, composite or unreinforced metal doors.

- **SN-104** – interlock bracket pack of (4) 10-24 sex nuts for all fire rim and Squarebolt® devices.
- **SN-134** – pack of (4) 1/4-20 sex nuts for all devices.

TORX® Security Screws:

Available for factory product orders. Wood screws may only be used in predrilled pilot holes of solid core wood doors.

accessories/options

long tailpiece kit

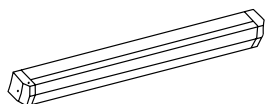
Long tailpiece kit for use with escutcheon series trim, up to 4-1/2" thick doors.

Door Thickness	Trim Type	Part Number
2" - 2-1/2"	620F and 630F Series Trim	81-9500-1665-000
2-1/2" - 3-1/2"	620F and 630F Series Trim	81-9500-1635-000
3-1/2" - 4-1/2"	620F and 630F Series Trim	81-9500-1636-000

Specify part number to order.

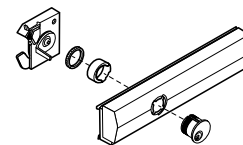
720 dummy pushbar

For push-pull vestibule doors leading to doors with 7000 series exit devices. Bars fit doors up to 48" (122cm) wide. Same finishes as devices. Specify 720 x finish.



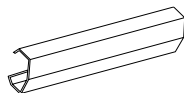
cylinder dogging

Cylinder dogging is available for all panic-listed exit devices only. Requires use of 1-1/8" mortise cylinder. When ordered with a device, cylinder must be ordered separately. (See How to Order, "Fourth Digit", page 53.) Cylinder dogging kit available; specify 715-48 (cylinder not included with this kit).



730 touchpad cover

Field replacement cover to renew touchpad looks. Specify 730-36 or 730-48 x finish.

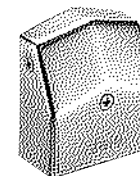


lumi-lite® touchpad cover

The Lumi-Lite® touchpad cover can be ordered separately and easily retrofits to existing 7000 exit devices in the field. To order specify: 730-36LUM for 36" cover and 730-48LUM for 48" cover

replacement end cap

The 7000 series replacement end cap is designed with heavy-duty material with three screw holes in strategic locations to resist abuse and maintain functionality. The ECK7 kit is available for easy retrofit to existing exit devices. To order retrofit kit, specify ECK7 x finish.



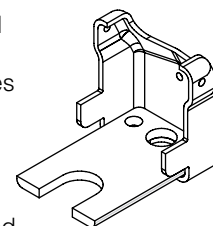
flush end cap

The flush end cap is a heavy-duty flush mounted end cap constructed of solid cast or stainless steel materials. For use on exit devices subject to abuse by vehicles being pushed through the doorway opening; i.e. carts, gurneys, wagons, etc. To order with device, specify option: ECK1. Available as a retrofit kit for existing installations, to order specify part number: 81-9500-0620 x finish.



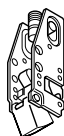
reinforced end cap**

This end cap consists of a solid steel plate welded to the end bracket which evenly distributes impact forces over a larger surface area, thus eliminating point loading. To order with device, specify option ECK3. To order separately, specify kit model number ECK3. Kit includes reinforced bracket, end cap and (6) 1/4" x 20 screws.



bottom pullman latch

Optional bottom pullman latch available for panic listed vertical rod exit devices. To order with devices, specify "BPL." 702 bottom strike required, see page 46.



**Note: Six 1/4 x 20 screws come standard with either ECK3 option or kit. Only two screws required to fasten end cap assembly to door for retrofit. Other four screws are used with SquareBolt® Latch Head if ordered as an ECK3 option with complete device. When the kit is ordered a new end cap is also supplied, finish must be specified.

accessories/options

anti-pry bracket

The anti-pry bracket offers end users increased security by improving resistance against jamb spreading during a pry attack. When the door is in the closed position, the anti-pry bracket interlocks in position between the exit device strike and frame preventing the strike and exit device latch from being separated. For use with all 7100(F) rim and 7150(F) SquareBolt® devices. Kit includes interlock bracket and end cap shim, the standard exit device mounting screws can be used, therefore, no additional fasteners are required. Black powder coat finish. To order specify option/model number: 725

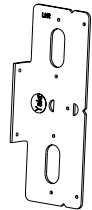


less bottom rod

7170(F90) surface and 7160(F90) concealed vertical rod exit devices available less bottom rod. Fire-rated devices supplied standard with a heat-activated door bolt popper. To order, suffix LBR.

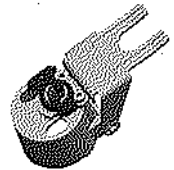
plastic installation template

Provided as a standard with all 7000 series exit device, the plastic installation template facilitates door markings over traditional paper templates. This provides a more accurate door prep which reduces installation mistakes and overall installation time. Template dimensions: 8-1/4" x 3-1/4" (210mm x 83mm). To order separately, specify part number: 60-7000-9100-999.



Schlage® cam assembly

This cam and housing assembly includes a cam engineered to accept Schlage rim cylinders. No modifications are required to existing 500 and 600 series exit device trims thus maintaining the trim's classroom and storeroom functions. To order, specify part number: 60-7000-0815.



Von Duprin® tailpiece

This tailpiece is available for the Yale® 1109 rim cylinder to operate the night latch function for Von Duprin exit devices. To order, specify model number: 1145VD.

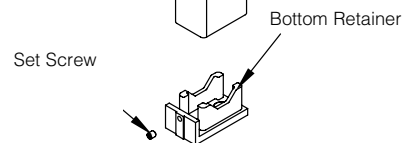
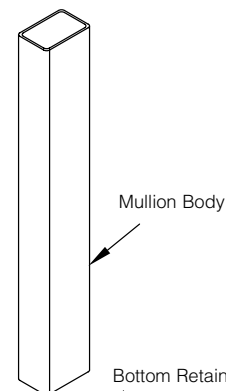
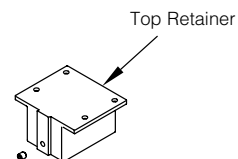


mullions

M200(F) removable mullion

M200(F) steel mullions are for use with 7100(F) series exit devices. Mullions may be field cut to fit opening. Red primer finish.

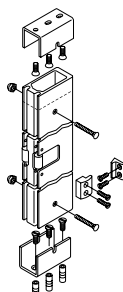
- M200 panic rated.
Tubular steel, 2" x 3" (51mm x 76mm). Specify 7', 8', or 10'.
- M200F 3 hour fire rated.
Tubular steel, 2" x 3" (51mm x 76mm). Specify 7' or 8'.
- M200FWS 3 hour fire rated.
Certified hurricane resistant (refer to local codes).
Tubular steel, 2" x 3" (51mm x 76mm). Specify 7' or 8'.



M200(F)

M300 removable mullion

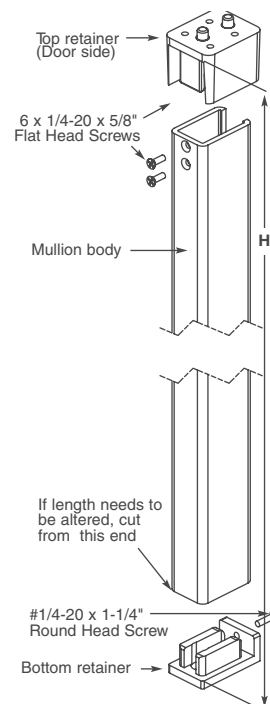
M300 mullions are for use with 7200 series exit devices. They consist of an aluminum extrusion 1-1/4" x 3" (32mm x 76mm), with built-in strikes for device bolts. Supplied with mounting brackets, mechanical fasteners, and mullion stabilizers. Available finishes are 628 (Satin, clear anodized) and 695 (dark amber coat). Specify 8', 9', or 10'.



M300

102S mullion stabilizer kit

Recommended for high openings and whenever door movement must be further restricted. Supplied standard with M300 mullions. To order separately, specify 102S.




M200FWS

mullions

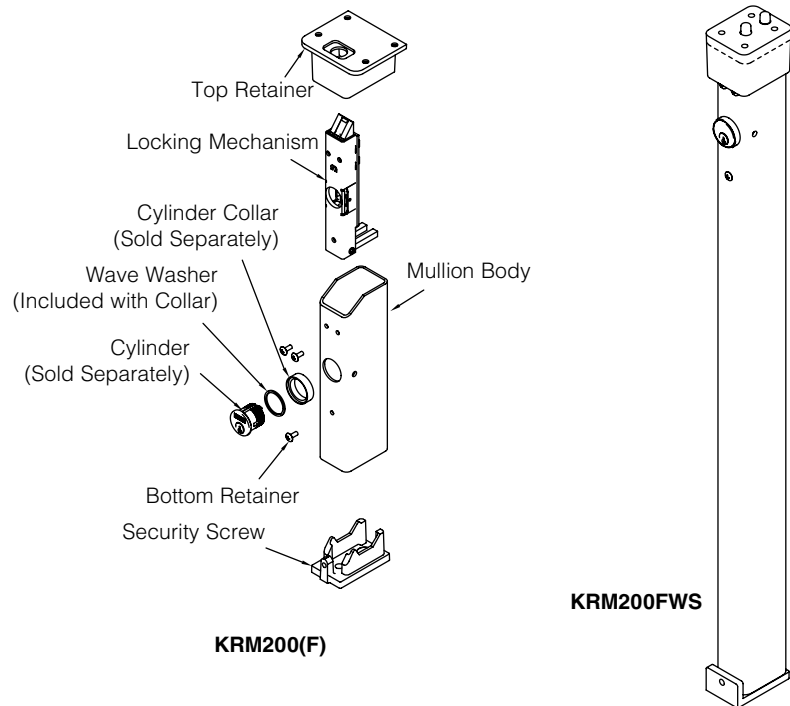
KRM200(F) keyed removable mullion (KRM)

Keyed removable mullions are for use with 7100(F) series exit devices. They are designed for simple removing when an unobstructed large opening is required and easy replacement and locking to maintain the integrity of the opening.

- KRM200 panic rated. Specify 7', 8', or 10'.
- KRM200F 1-1/2 hour fire rated. Specify 7' or 8'.
- KRM200FWS 3 hour fire rated.
Certified hurricane resistant (refer to local codes). Specify 7' or 8'.  Hurricane

KRM features

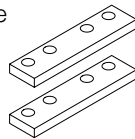
- Easy cylinder installation.
- Mullion automatically relocks when reinstalled without the use of the cylinder key.
- When ordering, add KR prefix to mullion, example: KRM200 and KRM200F.



M200(F) and KRM options

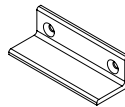
- **M203 Spacer Block**

Recommended for double rabbeted frames where the stop face width is less than the mounting hole spacing or for applications with 5-3/4" (146mm) or less door frames.



- **M204 Angle Bracket**

Recommended for any header configuration with less than 3" (76mm) of mounting surface.



KRM cylinders

As with any exit device trim, you must order a cylinder and collar if one is required. The Yale® keyed removable mullion accepts a mortise cylinder. Refer to page 45 for details.

facts and figures

7100 Series
(all variables)

Series	"A"	"B"
7100-36	<u>32-7/8"</u> (835mm)	<u>18"</u> (457mm)
7100F-36		
7100-48	<u>44-7/8"</u> (1130mm)	<u>24"</u> (610mm)
7100F-48		

7200 and 7200M Series
(all variables)

Series	"A"	"B"
7200-36	<u>34-5/8"</u> (880mm)	<u>18"</u> (457mm)
7200M-36	<u>32-7/8"</u> (835mm)	<u>18"</u> (457mm)
7200MF-36		
7200-48	<u>46-5/8"</u> (1184mm)	<u>24"</u> (610mm)
7200M-48	<u>44-7/8"</u> (1130mm)	<u>24"</u> (610mm)
7200MF-48		

trim dimensions

<p>620F/650F Series</p> <p>Projection: 13/16" (20mm)</p>	<p>630F/660F Series</p> <p>Projection: 2-3/4" (70mm)</p>	<p>500F Series</p> <p>Projection: 1/4" (6mm)</p>
<p>510F Series</p> <p>Projection: 2-1/8" (54mm)</p>	<p>680F Series</p> <p>Projection: 3" (76mm)</p>	<p>480F Series</p> <p>Projection: 2-7/8" (73mm)</p>

*Length varies by pull, see page 31

sample specifications

specification

Exit devices shall be 7000 Series Pushpad Exit Devices as manufactured by Yale Locks & Hardware.

The exit device chassis shall be cold forged steel, electroplated for corrosion resistance, and shall be architecturally finished brass, bronze or stainless steel. The pushpad mechanism shall be constructed of extruded aluminum and shall be scalped with architecturally finished brass, bronze or stainless steel. The maximum projection shall be 3-1/4" when the pushpad is active and 2-3/4" when the pushpad is dogged down. Nylon bearings and stainless steel springs shall be used for long life and durability; only torsion springs are acceptable. Rear and active case covers shall be wrought brass or bronze and shall be plated to match the exit bar. Plastic or painted covers are not acceptable. Latchbolts shall be steel and shall incorporate a deadlocking latch for increased security. Devices without deadlocking latches are not acceptable. Mounting screws shall be concealed to deter tampering. Devices shall be closed on all sides with no pinch points. Exit devices shall be easily field sized to accommodate various door widths.

Panic-listed exit devices shall have single point, one quarter turn hex key dogging standard. Optional cylinder dogging shall be available on panic listed devices. Devices with hex key dogging shall be easily field converted to cylinder dogging. Panic listed devices shall be available less dogging.

Trims shall be throughbolted with concealed fasteners. Escutcheon and pull-type trims shall be constructed of brass or bronze. All lever trims shall use cast or forged levers. On rim, SquareBolt® and vertical rod trims with cylinders, the mechanism that locks and unlocks the trim shall be housed in the trim and not in the active case of the exit device. Lever trims (except mortise) shall be Free-Wheeling with clutch mechanism allowing lever to rotate 60° when locked to prevent vandalism. Lever trims shall match those on Yale® mortise and cylindrical locksets.

Exit devices and trims shall be furnished in ANSI/BHMA standard architectural finishes.

Exit devices shall be listed by Underwriters Laboratories (UL) for safety as panic hardware. Fire-rated devices shall be listed for A label and lesser class doors.

Certification:
ANSI/BHMA A156.3, Grade 1

Devices, trims and cylinders shall be from one manufacturer.

Devices and 600 Series trim shall carry a five-year limited warranty.

500 Series trim shall carry a one-year limited warranty.

Electronic components shall carry a two-year limited warranty.

SecureX® delayed egress specification

Delayed egress exit devices shall be 7100/7200 Series (rim, SquareBolt®, mortise or concealed vertical rod) with the "D" suffix, manufactured by Yale Locks & Hardware.

The *SecureX* delayed egress device secures the door in the locked mode. Depressing the pushpad for less than three seconds will sound the device siren without initiating the alarm. Depressing the pushpad longer than three seconds will initiate an irreversible local audible beeping tone and allow the device to release for egress after 15 seconds. The alarm will continue until reset by the mechanical key switch located on the device. (When acceptable by local code agency, the delay period may be increased to 30 seconds, or other approved amount of time. Consult factory.)

Devices shall be 24 volts DC.

The exit device chassis shall be cold forged steel, electroplated for corrosion resistance, and shall be architecturally finished brass, bronze or stainless steel. The pushpad mechanism shall be constructed of extruded aluminum and shall be scalped with architecturally finished brass, bronze or stainless steel. The maximum projection shall be 3-1/4" when the pushpad is active and 2-3/4" when the pushpad is depressed. Nylon bearings and steel springs shall be used for long life and durability. Active case and alarm end cover shall be wrought brass, bronze or stainless steel and shall be plated to match the exit bar. Painted or plastic covers or end caps are not acceptable. Latchbolts shall be steel and shall incorporate a deadlocking latch for increased security. Devices without deadlocking latches are not acceptable. Mounting screws shall be concealed to deter tampering. Devices shall be closed on all sides with no pinch points. Device active cover and end cap attaching screws shall be security TORX®. When required, door position switches used on rim or *SquareBolt* devices shall be incorporated into the latch assembly of the device to allow added security.

Trims shall be through-bolted with concealed fasteners. Escutcheon and pull-type trims shall be constructed of brass, bronze or stainless steel. All lever trims shall use cast or forged levers. On rim, *SquareBolt* and vertical rod trims with cylinders, the mechanism that locks and unlocks the trim shall be housed in the trim and not in the active head of the exit device. Lever trims shall match those on *Yale* mortise and cylindrical locksets. Lever trims (except mortise) must have a clutch or Free-Wheeling spring assembly when in the locked mode to deter vandalism or damage to trim. Rigid lever trims are not acceptable.

Exit devices, trims and cylinders must be from one manufacturer.

7100(F) RIM

The 7100(F) is a rim exit device to be used with single doors or pairs of doors constructed of metal, wood or composite materials. Designed for application in high-use areas, the 7100(F) comes in a variety of finishes and can be combined with a variety of trims to match any desired style.



CERTIFICATION/COMPLIANCE

UL/cUL Listed:	FVSR/FVSR7 - Panic hardware GXHX/GXHX7 - Fire exit hardware (F) (4' x 8' single, 8' x 8' pairs, 3 hr.)
ANSI Certified:	A156.3 Type 1, Grade 1
BHMA Listed:	Directory of Certified Products

FEATURES

- Designed for wide stile doors
- 3/4" throw deadlocking stainless steel Pullman latchbolt
- Electroplated ferrous components provide corrosion resistance
- Available in double cylinder function

APPLICATIONS

- Non-handed for easy installation
- Single swing doors
- Pairs of doors with removable mullions
- Metal, wood or composite door materials

SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	3/4" (19mm) deadlocking stainless steel Pullman-type
Strike:	757 (panic), 757F (fire), 793 optional (double door application)
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F Series heavy-duty trim (recommended), 520F utility trim, 530F pull/thumbpiece trim, 540F Series rose trim. See pages 15-17.
Options:	Cylinder dogging, Shim Kit # 723, Sex Nuts and Bolts
Warranty:	5-year limited

7110(F) SURFACE VERTICAL ROD

The 7110(F) is a surface vertical rod exit device to be used on wide stile or flush doors up to 8' where two-point latching is desired.

CERTIFICATION/COMPLIANCE

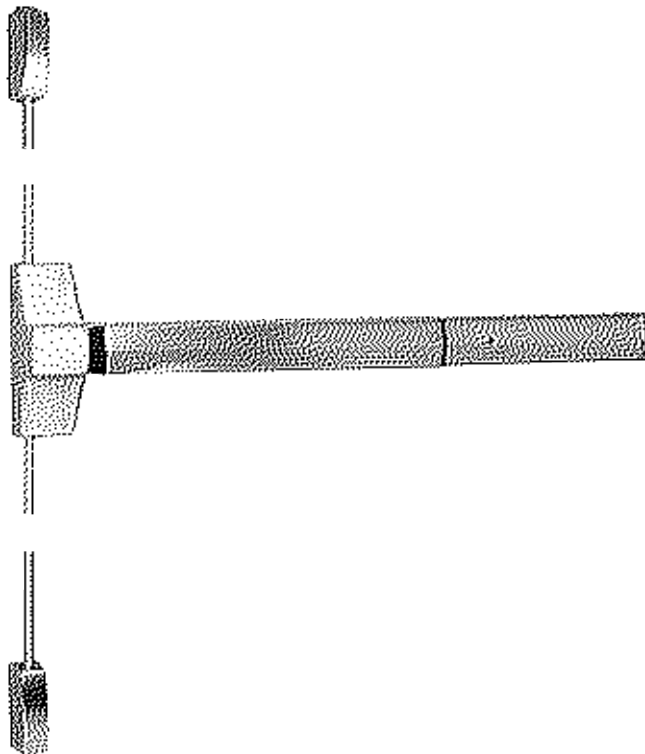
UL/cUL Listed:	FVSR/FVSR7 - Panic hardware GXHX/GXHX7 - Fire exit hardware (F) (8' x 8' pairs, 3 hr.)
ANSI Certified:	A156.3 Type 2, Grade 1
BHMA Listed:	Directory of Certified Products

FEATURES

- Designed for wide stile and flush doors
- Handed. Specify hand (field reversible)
- Bottom deadbolt for secure latching
- Fully adjustable roller strike

APPLICATIONS

- Pairs of doors
- Double egress
- Metal, wood or composite door materials



SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height 7'. Optional 8' available. For doors over 8', see the 7170(F) SVR.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, Pullman-type with automatic deadlatching Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
Vertical Rods:	1/2" O.D. tubular brass, bronze or stainless steel with rod guides
Strike:	Top: Roller type 791 (panic and fire). Bottom: Flush mounted 790 (panic and fire). 794 floor strike optional (threshold openings).
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F Series heavy-duty trim (recommended), 520F utility trim, 530F pull/thumbpiece trim, 540F Series rose trim. See pages 15-17.
Options:	Cylinder dogging, Shim Kit # 724, Sex Nuts and Bolts, 7010-2, 7010-6, 7010-12 rod extensions, bottom Pullman latch (panic only)
Warranty:	5-year limited

7120(F) CONCEALED VERTICAL ROD

The 7120(F) is a concealed vertical rod exit device to be used on metal doors only up to 8' in height where two-point latching is desired.

CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(8' x 8' pairs, 3 hr.)

ANSI Certified: A156.3 Type 8, Grade 1

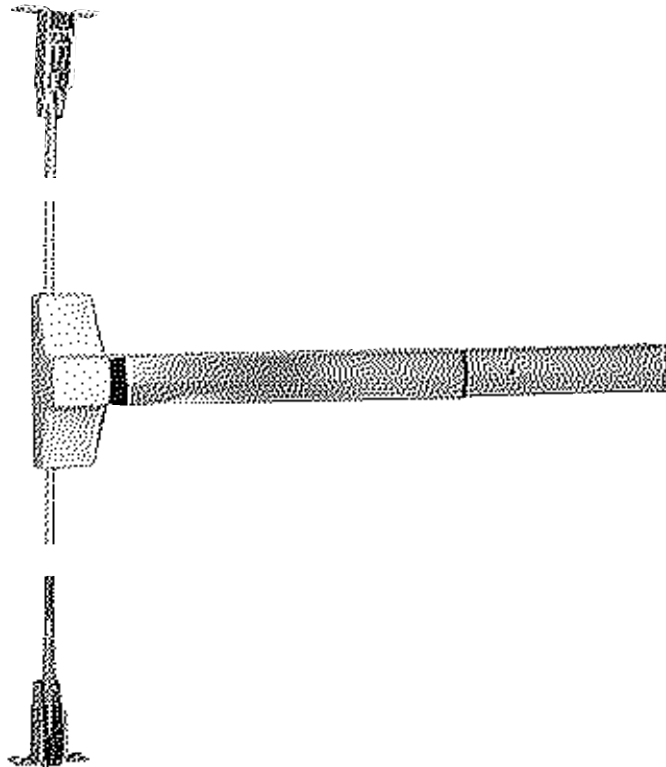
BHMA Listed: Directory of Certified Products

FEATURES

- Designed for wide stile and flush doors
- Handed. Specify hand (field reversible)
- Bottom deadbolt for secure latching
- Fully adjustable roller strike

APPLICATIONS

- Pairs of doors
- Double egress
- Metal doors only



SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height adjustable to 8'. For doors over 8', see the 7160(F) CVR.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, Pullman-type with automatic deadlatching Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
Vertical Rods:	1/2" (13mm) O.D. telescoping tubular rods
Strike:	Top: Roller type 791 (panic and fire). Bottom: Flush mounted 790 (panic and fire). 794 floor strike optional (threshold openings).
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F Series heavy-duty trim (recommended), 520F utility trim, 530F pull/thumbpiece trim, 540F Series rose trim. See pages 15-17.
Options:	Cylinder dogging, Shim Kit # 723, Sex Nuts and Bolts, 7010-2, 7010-6, 7010-12 rod extensions, bottom Pullman latch (panic only).
Warranty:	5-year limited

7130(F) MORTISE

The 7130(F) is an exit device integrated with the Yale® 8700 Series Mortise Lock for use on single doors or active leaf of a pair of doors where life safety and extra security are required. The 8700 Series Mortise Lock used is modified for use with the exit device only. The standard 8700 mortise lock cannot be used.

CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(4' x 8' single, 8' x 8' pairs, 3 hr.)
(4' x 9' single, 8' x 9' pairs, 1-1/2 hr.)

ANSI Certified: A156.3 Type 3, Grade 1

BHMA Listed: Directory of Certified Products



FEATURES

- Designed for wide stile and flush doors
- Handed; specify hand
- Two-piece mechanical 3/4" throw deadlocking stainless steel latchbolt
- Easily disassembles for maintenance and service
- Available in double cylinder function

APPLICATIONS

- Single swing doors
- Pairs of doors with vertical rod devices or automatic flush bolts
- Metal, wood or compatible door materials

Order As Follows, According To Function.

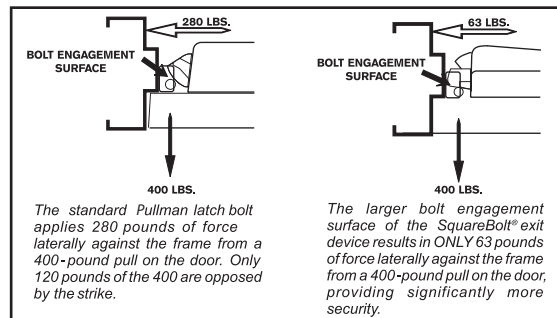
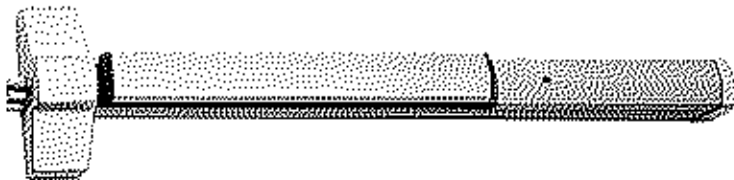
7130-K5(F)	(01) Exit only
	(02) Entry by pull or rigid knob when dogged.
	(03) Key retracts latchbolt
7130-L5(F)	Electrical control for 552F and 652F knob trim, w/wo key override.
	(02) Entry by rigid lever when dogged.
	(03) Key retracts latchbolt.
7130-T5(F)	Electrical control for 556F and 652F lever trim, w/wo key override.
	(02) Entry by pull when dogged.
	(03) Key retracts latchbolt.
7130-K8(F)	(08) Entry by knob lock/unlocked by key or knob only (passage)
7130-L8(F)	(08) Entry by lever lock/unlocked by key or lever only (passage)
7130-L8(F)-2	(08) Entry by lever lock/unlocked by key either side or lever only (passage)
7130-T8(F)	(05) Entry by thumbpiece lock/unlocked by key or thumbpiece only (passage)

SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Two piece mechanical 3/4" (19mm) deadlocking stainless steel with anti-friction insert and auxiliary deadlocking latch
Strike:	Curved lip, non-handed 798. Optional 712 for door pairs with astragals. Optional 718 open back strike.
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	650F Series heavy-duty trim (recommended), 550F utility trim, 560F cylinder x pull/thumbpiece trim. See pages 15-17.
Electric Strikes:	Compatible with Folger Adam® 300, 500, 600, 700 Series strikes (consult factory for specific model).
Options:	Cylinder dogging, Shim Kit # 723, Sex Nuts and Bolts.
Warranty:	5-year limited.

7150(F) SQUAREBOLT®

Just as easy to open as traditional latchbolts, the SquareBolt® exit device's unique construction offers innovative protection. Its patented *SquareBolt* (Pat. no. 5,605,362) design presents an improved physical barrier over standard rim latchbolts. The *SquareBolt* exit device locks into place and stays there. Credit cards, crowbars, door rattling and shaking are resisted, significantly reducing the threat of unauthorized entry.



CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 -
Fire exit hardware (F)
(4' x 8' single, 8' x 8' pairs, 3 hr.)

ANSI Certified: A156.3 Type 1 or 28, Grade 1
BHMA Listed: Directory of Certified Products
U.S. Patent #: 5,605,362

FEATURES

- Patented *SquareBolt* security deadbolt (Pat. no. 5,605,362) designed for maximum holding power
- Non-handed for easy installation
- Can be retrofitted onto existing 7100 Series templated doors
- Fully adjustable surface-mounted 3/8" diameter roller strike complete with positive locking plate and shims
- Available in double cylinder function

APPLICATIONS

- Single swing doors
- Pairs of doors with removable mullions
- Metal, wood or composite door materials

SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Deadbolt:	Patented 1" (25mm) slide projection bolt with full 3/4" (19mm) projection
Strike:	757 (panic), 757F (fire), 793 optional (double door application)
Trims:	620F Series heavy-duty trim (recommended), 520F utility trim, 530F pull/thumbpiece trim, 540F Series rose trim. See pages 15-17.
Options:	Cylinder dogging, Shim Kit # 723, Sex Nuts and Bolts
Warranty:	5-year limited

7160(F90) CONCEALED VERTICAL ROD

The 7160(F90) is a concealed vertical rod exit device to be used on wood and metal doors up to 10' where two-point latching is desired. A Less Bottom Rod (LBR) option is available.

CERTIFICATION/COMPLIANCE

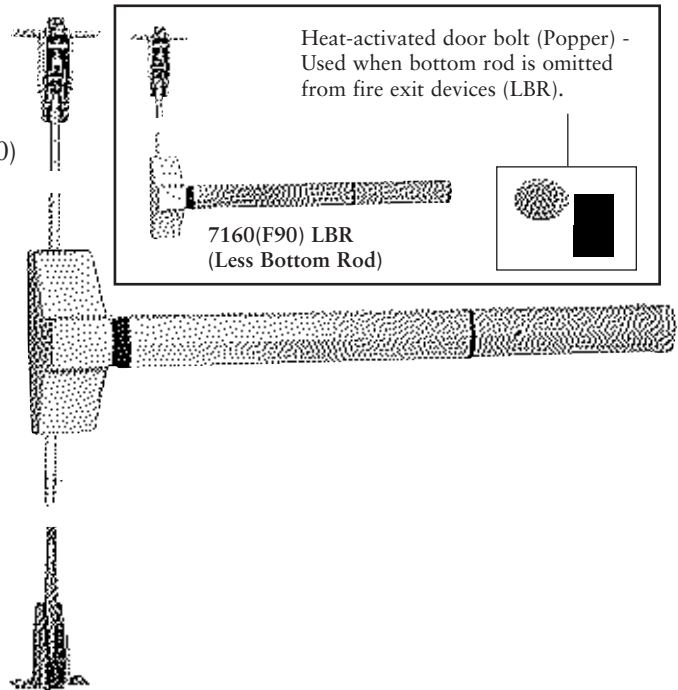
- UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F90)
(8' x 10' pairs, 1-1/2 hr.)
- ANSI Certified: A156.3 Type 7 and 8, Grade 1
- BHMA Listed: Directory of Certified Products

FEATURES

- Designed for wide stile and flush doors
- Handed. Specify hand (field reversible)
- Mortised top strike
- Available less bottom rod (LBR option)

APPLICATIONS

- Pairs of doors
- Double egress
- Metal or wood doors



SPECIFICATIONS

- Door Opening Width:** -36 for 30" - 36" (762 - 914mm) doors
-48 for 36-1/2" - 48" (927 - 1219mm) doors
Optional sizes can be special ordered. Consult Technical Product Support.
- Door Opening Height:** Standard door height adjustable to 8'. Optional heights specify suffix -9, -10.
- Door Thickness:** 1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
- Minimum Stile Width:** 4-1/2" (114mm)
- Projection:** 3-1/4" (83mm) active, 2-3/4" (70mm) dogged
- Latchbolt:** Top: 3/4" (19mm) throw, Pullman-type with automatic deadlatching
Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
- Vertical Rods:** 1/2" (13mm) O.D. telescoping tubular rods
- Strike:** Top: 761 mortised (panic and fire). Bottom: Flush-mounted 790 (panic and fire).
794 floor strike optional (threshold openings).
- Fasteners:** Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
- Trims:** 540F Series Rose Trim and 620F Series Heavy-Duty Escutcheon Trim. See pages 15 and 16.
- Electric Strikes:** LBR panic-only devices compatible with Folger Adam® 310-6 Series strikes.
Suffix ES when ordering.
- Options:** Cylinder dogging, Shim Kit # 723, Sex Nuts and Bolts, Less Bottom Rod (LBR),
-9, -10 opening height, 7010-2, 7010-6, 7010-12 rod extensions, bottom Pullman
latch (panic only).
- Warranty:** 5-year limited

7170(F90) SURFACE VERTICAL ROD

The 7170(F) is a surface vertical rod exit device to be used on wide stile and flush doors up to 10' where two-point latching is desired. A Less Bottom Rod (LBR) option is available.

CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(8' x 10' pairs, 1-1/2 hr.)

ANSI Certified: A156.3 Type 2, Grade 1

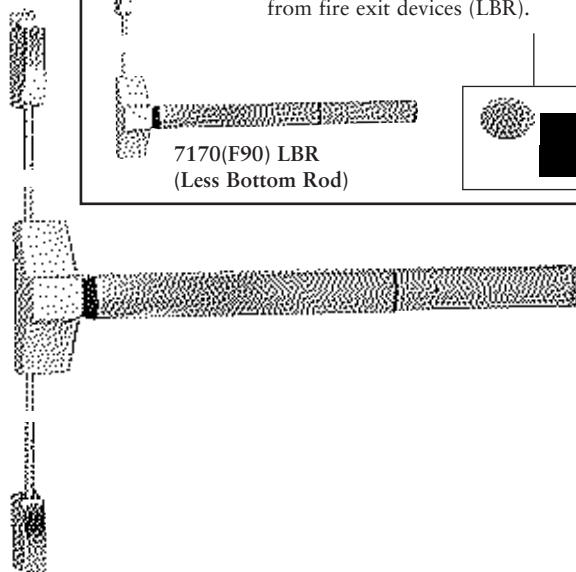
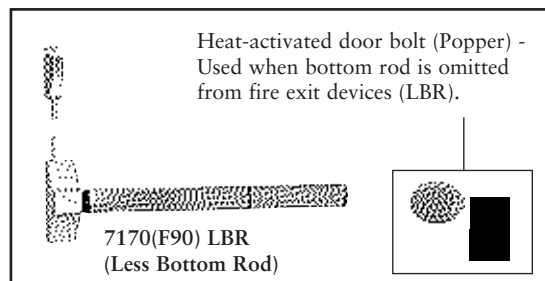
BHMA Listed: Directory of Certified Products

FEATURES

- Designed for wide stile and flush doors
- Handed. Specify hand (field reversible)
- Interlocking top strike and latch mounting plate
- Available less bottom rod (LBR option)

APPLICATIONS

- Pairs of doors
- Double egress
- Metal or wood doors

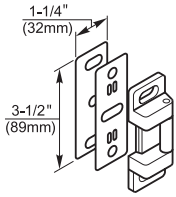


SPECIFICATIONS

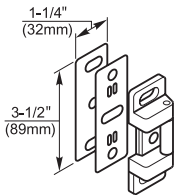
Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height 7'. Optional heights specify suffix -8, -9, -10.
Door Thickness:	1-3/4" (44mm) standard. 2" and 2-1/4" (51mm and 57mm) optional; specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, Pullman-type with automatic deadlatching Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
Vertical Rods:	1/2" (13mm) O.D. tubular brass, bronze or stainless steel with rod guides
Strike:	Top: 726 (panic and fire). Bottom: Flush-mounted 790 (panic and fire). 794 floor strike optional (threshold openings).
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	620F Series heavy-duty trim (recommended), 520F utility trim, 530F pull/thumbpiece trim, 540F Series rose trim. See pages 15-17.
Electric Strikes:	LBR panic-only devices compatible with Folger Adam® 310-4 Series Strikes. Suffix ES when ordering.
Options:	Cylinder dogging, Shim Kit # 724, Sex Nuts and Bolts, bottom Pullman latch (panic only), Less Bottom Rod (LBR), -8, -9, -10 opening height, 7010-2, 7010-6, 7010-12 rod extensions.
Warranty:	5-year limited

STANDARD & OPTIONAL STRIKES

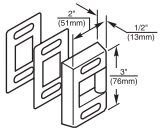
RIM DEVICES



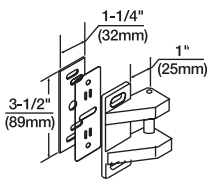
757
Standard 710X,
715X, 720XM



757F
Standard on
7100F, 7150F,
7200MF.



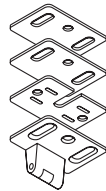
759
Standard 720X



793
Optional strike
for double door
applications.

VERTICAL ROD DEVICES

Top Strikes



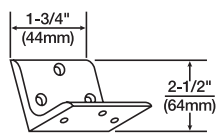
791
Standard top
strike for 711X,
7110F, 712X,
7120F, 721XM,
7210MF, 722XM,
7220MF, 721X,
722X.



726
Standard top
strike for 717X,
7170F.



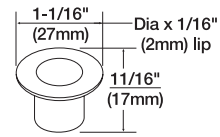
761
Standard top
strike for 716X,
7160F.



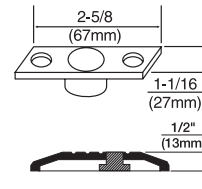
797 Bracket
Optional bracket
for SVR top
strike in flush
transom opening.

VERTICAL ROD DEVICES

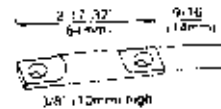
Floor Strikes



790
Standard floor
strike for 711X,
7110F, 712X,
7120F, 717X,
7170F, 716X,
7160F, 721XM,
7210MF,
722XM,
7220MF, 721X,
722X.

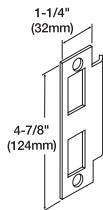


794
Optional floor
strike for fire
openings using
threshold or
flush floor
mount.

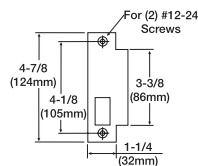


702
Optional floor
strike for
bottom Pullman
latch option.

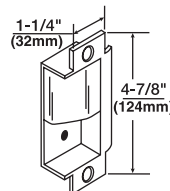
MORTISE DEVICES



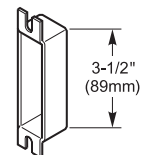
798
Standard on 7130, 7130F



712 Flat ANSI Strike
Optional for door pairs
with astragals (7/8" lip)



718 Open Back Strike
Optional for pairs of
doors where allowed by
door manufacturer

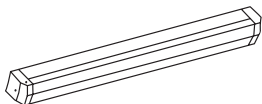


Options
202 Strike box for
ANSI strikes

OPTIONS

720 RIGID BAR

For push-pull vestibule doors leading to doors with 7000 Series exit devices. Bars fit doors up to 48" (1.22m) wide. Same finishes as devices. Specify 720 x finish.



SPECIALTY FASTENERS

Sex nuts, required for wood, composite or unreinforced metal doors.

SN-104, Interlock bracket pack of (4) 10-24 sex nuts for all fire rim and Squarebolt devices.

SN-134, pack of (4) 1/4-20 sex nuts for all devices.

TORX® Security Screws available for factory product orders. Wood screws may only be used in predrilled pilot holes of solid core wood doors.

EXTENSION RODS

Model #	Length
7010-2	2" (51mm)
7010-6	6" (152mm)
7010-12	12" (305mm)

Specify finish.

LONG SPINDLE KIT

Long spindle (tailpiece) kit for all series trim, up to 4-1/2" thick doors. Specify part number to order.

Part Number	Door Thickness	Trim Type
7000 Spindle Kit	2" - 2-1/4"	All Trim
81-9500-1633-000	2-1/2" - 3-1/2"	520F, 620F Series Lever & Knob Trim
81-9500-1634-000	3-1/2" - 4-1/2"	520F, 620F Series Lever & Knob Trim
81-9500-1635-000	2-1/2" - 3-1/2"	530F Series Thumbpiece Trim
81-9500-1636-000	3-1/2" - 4-1/2"	530F Series Thumbpiece Trim

7000 Series Exit Device

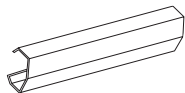
BOTTOM PULLMAN LATCH

Optional bottom Pullman latch available for panic listed vertical rod exit devices. To order, specify "bottom Pullman latch".



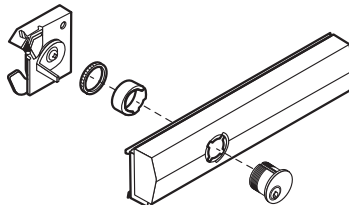
730 36/48 TOUCHPAD SCALP

Field replacement scalp to renew touchpad looks. Specify 730-36 or 730-48 x finish.



CYLINDER DOGGING

Cylinder dogging is available for all panic-listed exit devices only. Requires use of 1-1/8" mortise cylinder. When ordered with a device, 6-pin 2153 cylinder is supplied standard. (See How to Order, "Fourth Digit", page 47.) Cylinder dogging kit available; specify 715-48 (cylinder not included with this kit).

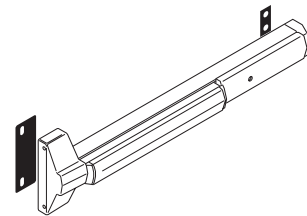


END CAP



The 7000 series impact-resistant end cap is designed with heavy-duty material with three screw holes in strategic locations to resist abuse and maintain functionality. The ECK7 kit is available for easy retrofit to existing exit devices. To order retrofit kit, specify ECK7 x finish.

SHIM KITS



Shim kits, for devices on doors with interfering molding, are available. Each shim kit contains 2 sets of 1/8" thick shims to shim a device 1/8" (3mm) or 1/4" (6mm). Longer device mounting screws (not included) are required for more than 1/4" (6mm) shimming. 693 (Black) finish.

723, Shim Kit for 7100(F) Series Rim, 7150(F) Series SquareBolt®, 7120(F) Series* Concealed Vertical Rod, and 7130(F) Series* Mortise Exit Devices.

723NS, Shim Kit for 7200 Series Rim, 7200M(F) Series Rim, 7250 Series SquareBolt, 7250M(F) Series SquareBolt, 7220 Series* and 7220M(F)* Concealed Vertical Rod Exit Devices.

724, Shim Kit for 7110(F) and 7170(F) Series Surface Vertical Rod Exit Devices.

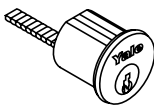
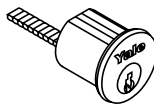
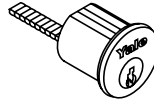
724NS, Shim Kit for 7210(F) Series Surface Vertical Rod Exit Devices.

*Note: Special mortise or concealed vertical rod components needed for openings requiring more than (2) shim kits, or for shimmed mortise devices in doors over 1-3/4" (44mm) thick. Details on application.

LESS BOTTOM ROD


7170(F90) surface and 7160(F90) concealed vertical rod exit devices available less bottom rod. Fire-rated devices supplied standard with a heat-activated door bolt popper. To order, suffix LBR.

CYLINDERS

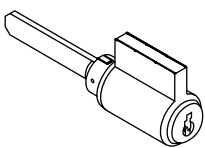
		Application:	Cylinder(s)	Description	Cylinder Ring	Mounting Screws	
Rim Cylinder	Narrow Escutcheon Trim 500F/510F Series Rim cylinders with special # 599 cylinder rings. NOT AVAILABLE with U5109 cylinder.		7200, 7200M, 7200MF Rim	1109 / 5109 6-pin	Standard / Security	599-419	60-7000-1235-048
			7250, 7250M, 7250MF	1109 / 5109 7-pin	Standard / Security	599-419	60-7000-1235-048
			SquareBolt®	1193 / 5193 6-pin	I.C. / Sec. I.C.	599-544	10-1193-1018-048
			7210, 7210M, 7210MF SVR	1193 / 5193 7-pin	I.C. / Sec. I.C.	599-544	10-1193-1018-048
			7220, 7220M, 7220MF CVR	1709 6-pin	CMK Cylinder	599-544	34-2311-8738-048
				1709 7-pin	CMK Cylinder	599-700	34-2311-8738-048
	Standard Escutcheon Trim 520F/530F Series Rim Cylinders		7100(F), 7100(F)-2 Rim	1109 / 5109 6-pin	Standard / Security	1765-250	60-7000-1235-048
			7150(F), 7150(F)-2	U5109 6-pin	High Security	----	60-7000-1235-048
			SquareBolt®	1109 / 5109 7-pin	Standard / Security	1765-250	60-7000-1235-048
			7110(F), 7170(F) SVR	U5109 7-pin	High Security	1766	60-7000-1235-048
			7120(F) CVR	1709 6-pin	CMK Cylinder	1765-656	34-2311-8738-048
				1709 7-pin	CMK Cylinder	1765-656	34-2311-8738-048
	Heavy-Duty Escutcheon Trim 620F and 600 Series Electric Trim Rim Cylinders		7100(F), 7100(F)-2 Rim	1109 / 5109 6-pin	Standard / Security	----	60-7000-1235-048
			7150(F) 7150(F)-2	U5109 6-pin	High Security	----	60-7000-1235-048
			SquareBolt®	1109 / 5109 7-pin	Standard / Security	----	60-7000-1235-048
			7110(F), 7170(F) SVR	U5109 7-pin	High Security	----	60-7000-1235-048
			7120(F), 7160(F) CVR	1709 6-pin	CMK Cylinder	1765-250	34-2311-8738-048
				1709 7-pin	CMK Cylinder	1765-250	34-2311-8738-048
	1193 / 5193 6-pin	Std. / Sec. I.C.	1765-250	10-1193-1018-048			
	1193 / 5193 7-pin	Std. / Sec. I.C.	1765-344	10-1193-1018-048			

Note: Mounting screw part numbers shown are the screws to mount the cylinder.

Note: Same cylinder used for inside and outside on double cylinder exit device..

		Application:	Cylinder(s)	Description	Cylinder Ring	
Mortise Cylinder	Mortise Exit Devices Standard Escutcheon trim 550F/560F Series 	7130(F), 7130(F)-2 Mortise	2153/5153, 6 or 7-pin, 1-1/4" (29mm)	Standard / Security	1765 - .062	As with exit device trim you must order a cylinder to go with a keyed removable mullion. The Yale keyed removable mullion accepts a standard 6-pin 2153 mortise cylinder with cam # 2160. Other cylinders are optional. *U5153 6 and 7-pin cylinders cannot be used with a keyed removable mullion.
			2196 / 5196 6-pin	Std. I.C. / Sec. I.C.	1765 - .344	
			2197 / 5197 7-pin	Std. I.C. / Sec. I.C.	1765 - .531	
			U5153, 6 or 7-pin, 1-1/4" (32mm)	High Security	----	
	Mortise Exit Devices Heavy-Duty Escutcheon Trim 650F Series	7130(F), 7130(F)-2 Mortise	2153 / 5153, 6 or 7-pin, 1-1/2" (38mm)	Standard / Security	----	
			2196 / 5196 6-pin	Std. I.C. / Sec. I.C.	----	
			2197 / 5197 7-pin	Std. I.C. / Sec. I.C.	1765 - .062	
	Keyed Removable Mullions KRM100/100F	7100(F), 7150(F), 7200, 7250, 7200M(F), 7250(F)	2153/5153*, 6 or 7-pin, 1-1/8" (29mm)	Standard / Security	----	
			2196 / 5196 6-pin	Std. I.C. / Sec. I.C.	1765-250	
	Cylinder Dogging	Panic-rated devices	2153 , 6-pin, 1-1/8" (29mm)	Standard	----	
2153, 7-pin 1-1/4" (32mm)			Optional 7-pin	1765 - .156		
2196, 6-pin 1-1/2" (38mm)			Std. I.C. 6-pin	1765 - .406		
SecureX® & Alarm Kit	All exit devices	2197, 7-pin 1-11/16" (42mm)	Std. I.C. 7-pin	1765 - .594		

Note: Inside cylinder for double cylinder exit device is 2-3/4" (70mm) length with 1765-.250 ring

		Application:	Cylinder(s)	Description
Knob or Leverset Trim 540F Series Trim Keyed trim uses Yale® cylindrical lock cylinders.		7100(F) Rim 7150(F) SquareBolt 7110(F), 7170(F) SVR 7120(F) CVR	1801	6-pin Knob Cyl. (Std.)
			1802	6-pin Lever Cyl. (Std.)
			1802A	7-pin Lever Cylinder
			1210	6-pin I.C. Lever Cylinder
			1220	7-pin I.C. Lever Cylinder
			5802	6-pin Security Lever Cyl.
			5802A	7-pin Security Lever Cyl.
			5210	6-pin I.C. Security Cyl.
			5220	7-pin I.C. Security Cyl.
			107S	Adaptor kit for Schlage® Cyl.
			"B" Trim Prefix	Trim with lever for Best®, Arrow® or Falcon® IC cylinder (specify 6 or 7-pin)
"R" Trim Prefix*	Trim with lever for Corbin Russwin IC cylinder			

*AU & PB levers only.

Yale®
KeyMark® Refer to separate catalog section for availability.

FUNCTIONS

KNOB OR LEVER TRIMS

SquareBolt® 7150(F) 7250M(F) 7250		Rim 7100(F) 7200M(F) 7200		Surface Vertical Rod 7110(F) 7170(F90) 7210M(F) 7210		Concealed Vertical Rod 7120(F) 7160(F90) 7220M(F) 7220		Mortise 7130(F)		Type	ANSI Function No.	Function Description
										Exit Only/ Blank Plate	01 –	Exit only, no trim. Exit only, blank plate.
										Dummy	02	Entrance by trim when actuating bar is locked down.
										Nightlatch	03	Entrance by trim when latchbolt is retracted by key. Key removable only when locked.
										Classroom	08	Entrance by knob or lever. Key locks or unlocks knob or lever.
										Storeroom	09	Entrance by knob or lever only when released by key. Key removable only when locked.
										Passage	14	Entrance by trim when latchbolt is released by knob or lever. Knob or lever always active, no cylinder.

















































































Note: 09 and Free-Wheeling 02 achieved with a single modification at installation.

DOUBLE CYLINDER EXIT DEVICE LEVER TRIMS

SquareBolt® 7150(F)-2		Rim 7100(F)-2		Mortise 7130(F)-2		Type	ANSI Function No.	Function Description
Inside	Outside	Inside	Outside	Inside	Outside			
						Classroom	08	Entrance by lever. Key either side locks or unlocks lever.

FUNCTIONS

THUMBPIECE, THUMBTURN AND PULL TRIMS

SquareBolt® 7150(F) 7250M(F) 7250		Rim 7100(F) 7200M(F) 7200		Surface Vertical Rod 7110(F) 7170(F90) 7210M(F) 7210		Concealed Vertical Rod 7120(F) 7160(F90) 7220M(F) 7220		Mortise 7130(F)		Type	ANSI Function No.	Function Description
Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside			
										Exit Only/ Blank Plate	01 –	Exit only, no trim. Exit only, blank plate.
										Dummy/ Pull Plate	02	Entrance by trim when actuating bar is locked down.
										Nightlatch	03	Entrance by trim when latchbolt is retracted by key. Key removable only when locked.
										Classroom	05	Entrance by thumbpiece. Key locks or unlocks thumbpiece.
										Storeroom	06	Entrance by thumbpiece only when released by key. Key removable only when locked.
										Passage	15	Entrance by trim when latch is released by thumbpiece. Thumbpiece is always active, no cylinder.
										Classroom	11	Entrance by control turn piece. Key locks or unlocks control.
										Storeroom	12	Entrance by control turn piece only when released by turning key. Key removable only when locked.

Note: 06 and 12 achieved with a single modification at installation.



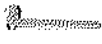

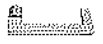
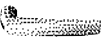


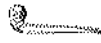
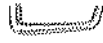
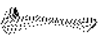

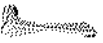

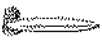

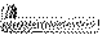

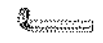
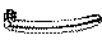


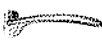

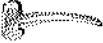


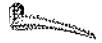

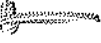
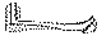
trim designs for escutcheons

standard

<p>Arcadia AR</p>  <p>Projection: 3-1/4" (82mm)</p>	<p>Augusta AU</p>  <p>Projection: 2-5/8" (61mm)</p>	<p>Carmel CR</p>  <p>Projection: 3-1/8" (79mm)</p>	<p>Jefferson JN</p>  <p>Projection: 2-9/16" (65mm)</p>
<p>Monroe MO</p>  <p>Projection: 3" (76mm)</p>	<p>Pacific Beach PB</p>  <p>Projection: 3-5/16" (84mm)</p>	<p>Pinehurst PN</p>  <p>Projection: 3-1/16" (78mm)</p>	<p>Virginia VI</p>  <p>Projection: 3-1/8" (79mm)</p>
<p>Hampton HA</p>  <p>Projection: 3-3/8" (86mm)</p>	<p>Copenhagen CO</p>  <p>Projection: 3-1/2" (90mm)</p>	<p>Litchfield LF</p>  <p>Projection: 2-7/8" (73mm)</p>	

Note: Projection dimensions are provided using the 620F series escutcheon plates.

Reflections®

	TA	TB	UB	TC	UC				
Hudson									
Projection	2-3/4" (70mm)	3-1/16" (78mm)	3-1/4" (83mm)	3" (76mm)	3-7/16" (87mm)				
	TE	TF	TI						
Danube									
Projection	3" (76mm)	3-3/16" (81mm)	3-3/8" (85mm)						
	TG	TO	TH	TJ	TK				
Seine									
Projection	2-13/16" (71mm)	3-1/2" (89mm)	3-3/8" (85mm)	3-1/16" (78mm)	3-1/4" (83mm)				
	TL	TM	TN	TP	TR	TS	TQ		
Thames									
Projection	2-7/8" (73mm)	3-1/16" (78mm)	3-1/16" (78mm)	3-5/16" (84mm)	3-1/16" (78mm)	3-1/8" (80mm)	3-1/16" (78mm)		
	TT	TU	TV	TW	UW	TX	UX	TU	TZ
Victoria									
Projection	2-11/16" (68mm)	3-1/4" (83mm)	3-1/2" (89mm)	3" (76mm)	3-7/16" (87mm)	3-5/8" (92mm)	3-7/16" (87mm)	3-5/16" (84mm)	3-7/16" (87mm)

Note: Projection dimensions are provided using the 620F series escutcheon plates.

7100 series trims

620F and 650F series escutcheon trim

- Certified ANSI/BHMA A156.3, Grade 1. **BHMA CERTIFIED**
- Trim through-bolts to exit device for strength.
- Beveled sides improve attack resistance.
- Solid forged escutcheon and Free-Wheeling trim resists vandalism and abuse.
- Flush cylinder in 6-pin applications for additional security.
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- Dimensions: 3" x 10-1/4" x 13/16" (76mm x 260mm x 19mm).
- Cylinders not included. See page 42 & 44 for cylinder options. 1-1/2" mortise cylinder required for mortise trim.

- Available with AR, AU, CR, JN, MO, PB, PN, VI, HA lever designs and CO, LF knob designs. See page 26.
 - Finishes: 605, 605e, 606, 606e, 609, 611, 612, 613, 613e, 616, 619, 620, 626, 629, 630, 693, 722
- Available with Reflections® lever designs. See page 26.
 - Finishes: 605, 606, 611, 612, 613, 619, 626, 629, 630, 722
- Trim ordering example: AU626F x 626 x RHR.
- 5-year limited warranty.

Application	Cylinder	Classroom/ Storeroom Cylinder Controls Thumbturn	Exit Only Blank Plate	Nightlatch Access by Key	Classroom/ Storeroom Cylinder Controls Knob	Nightlatch Cylinder by Knob	Passage Active Knob	Dummy Trim Rigid Knob	Classroom Cylinder Controls Lever	Storeroom Cylinder Controls Lever	Nightlatch Cylinder by Lever	Passage	Dummy Trim Free-Wheeling	Dummy Rigid Lever
7100(F) 7150(F) 7110(F) 7120(F) 7160(F) 7170(F)	Rim	603F ¹	620F	621F ²	622F ¹	623F ²	624F	625F	626F	626F ¹	627F ²	628F	628F ¹	629F
7130(F)	Mortise	—	620F	651F	652F ³	652F	654F	654F	656F	—	656F	658F	—	658F
7100(F)-2 7150(F)-2	Rim x Rim	—	—	—	—	—	—	—	626F	—	—	—	—	—
7130(F)-2	Mortise x Rim	—	—	—	—	—	—	—	656F	—	—	—	—	—
ANSI		11/12	01	03	08/09	03	14	02	08	09	03	14	02	02

¹ 09, 12 and Free Wheeling 02 achieved with single trim modification at installation.

² Not recommended for use with vertical rod devices.

³ 08 only

For 626 finish the escutcheon is satin chrome plated to simulate stainless steel.

For 629 & 630 finishes the escutcheon is nickel plated to match stainless steel.

Free-Wheeling is not available on mortise trim.

For 620F series trim, optional door thickness available up to 4-1/2", specify on order.

7100 series trims

630F, 660F and 670F series pull/thumbpiece trim

- Certified ANSI/BHMA A156.3, Grade 1.
- Trim through-bolts to exit device for strength.
- Beveled sides improve attack resistance.
- Solid forged escutcheon resists vandalism and abuse.
- Flush cylinder in 6-pin applications for additional security.
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- Plate Dimensions: 2-3/4" x 15-1/2" x 5/8" (70mm x 394mm x 16mm).
- Pull Dimensions: 6-7/16" (164mm) on centers x 2-1/8" (54mm) projection.
- Cylinders not included. See page 42 & 44 for cylinder options. 1-1/2" mortise cylinder required for mortise trim.
- Finishes: 605, 605e, 606, 606e, 609, 612, 613, 613e, 616, 619, 620, 626, 629, 630, 693, 722
- Trim ordering example: 630F x 630
- 5-year limited warranty.

Applications	Cylinder	Exit Only Blank Plate	Nightlatch Access by Key	Nightlatch Cylinder by Pull	Classroom Cylinder Controls T-Piece	Storeroom Cylinder Controls T-Piece	Dummy Trim Pull Plate	Passage Active T-Piece
7100(F) 7100(F)-2 7150(F) 7150(F)-2 7110(F) 7120(F) 7160(F) 7170(F)	Rim	630F	631F ²	632F ²	633F	633F ¹	634F	635F
7130(F) 7130(F)-2	Mortise	630F K5F	661F K5F	662F K5F	673F T8F	--	634F K5F	675F T8F
ANSI		01	03	03	05	06	02	15

¹ 06 achieved with single trim modification at installation.

² Not recommended for use with vertical rod exit devices.

For 630F series trim, optional door thickness available up to 4-1/2", specify on order.

For 626 finish the escutcheon is satin chrome plated to simulate stainless steel.

For 629 & 630 finishes the escutcheon is nickel plated to match stainless steel.

680F series offset pull trim

- 1-3/4" (44mm) door standard. For doors through 2-1/4" (54mm) or shim-mounted devices, specify on order.
- Plate Dimensions: 3" x 10-1/4" x 13/16" (76mm x 260mm x 21mm)
- Pull Dimensions: 7-1/4" (184mm) on centers x 2-13/32" (61mm) projection.
- Trim through-bolts to exit device for strength.
- Beveled sides improve attack resistance.
- Solid forged escutcheon resists vandalism and abuse.
- Flush cylinder in 6-pin applications for additional security.
- Cylinders not included. See page 42 & 44 for cylinder options. 1-1/2" mortise cylinder required for mortise trim.
- Finishes: 605, 605e, 606, 606e, 609, 611, 612, 613, 613e, 616, 619, 620, 626, 629, 630, 693, 722
- Trim ordering example: 681F x 630 x LHR
- 5-year limited warranty

Applications	Cylinder	Dummy Pull	Nightlatch Access by Key
7100(F) 7100(F)-2 7150(F) 7150(F)-2 7110(F) 7120(F) 7160(F) 7170(F)	Rim	680F	681F*
7130(F) 7130(F)-2	Mortise	—	684F
ANSI	—	02	03

*Not recommended for use with vertical rod exit devices.

For 629 & 630 finishes the escutcheon is nickel plated to match stainless steel.

7100 series trims

540F series rose trim

- Certified ANSI/BHMA A156.3, Grade 1.
- 540F rose trim for stock doors (161 Prep).
- Trim through-bolts to exit device for strength.
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- AU, PB, MO and CA trim designs. See below.
- Accepts cylindrical type cylinders. Cylinders not included, see page 43 for cylinder options.
- Finishes: 605, 605e, 606, 606e, 609, 612, 613, 613e, 616, 619, 620, 625, 626, 693, 722
- "B" trim prefix - Lever trim accepting all small format interchangeable cores. 6- or 7-pin (Example: B-AU546F)
- "M" trim prefix - Lever trim accepting Medeco® (32 series) and ASSA® large format interchangeable cores. Available in AU lever only. 6-pin only. (Example: M-AU546F)
- "S" trim prefix - Lever trim accepting Schlage® standard cylinders. 6-pin only. (Example: S-AU546F)
- "SI" trim prefix - Lever trim accepting Schlage® large format interchangeable cores. 6-pin only. (Example: SI-AU546F)
- 3-year limited warranty.

Applications	Nightlatch Access by Key	Classroom Cylinder Controls Lever	Passage Lever	Dummy Trim Free-Wheeling Lever	Dummy Trim Rigid Lever	Classroom Cylinder Controls Knob	Dummy Trim Free-Wheeling Knob	Passage Knob
7100(F), 7150(F), 7110(F), 7120(F), 7160(F), 7170(F)	541F	546F	548F	548F	549F	CA542F	CA544F	CA544F
ANSI	03	08	14	02	02	08	02	14

121NL cylinder only

- Application: 7100(F) and 7150(F) rim and SquareBolt® exit devices. Not recommended for surface or concealed vertical rod devices.
- Must specify rim cylinder when ordering. See page 42 for cylinder options.
- Cylinder collar 1765.250 furnished standard for 1-3/4" thick doors.
- For 1109, 5109, K300, K640, A640 and 2109 cylinders:
 - Screw part number 34-2311-8738-048
 - Backplate part number 34-0010-1015-059
- For 1193, 5193 and K840 cylinders:
 - Screw part number 10-1193-1018-048
 - Backplate part number 34-0010-1015-059

Function Description	Nightlatch Access by Key
Model No.	121NL
ANSI	03



7200 & 7200M series trims

500F series escutcheon trim

- Certified ANSI/BHMA A156.3, Grade 1. **BHMA** CERTIFIED
- Trim through-bolts to exit device for strength.
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- Dimensions: 1-5/8" x 9-1/2" x 1/4" (41mm x 241mm x 6mm)
- Cylinders not included. See page 42 for cylinder options.

- Available with AR, AU, CR, JN, MO, PB, PN, VI, HA lever designs and CO, LF knob designs. See page 26.
 - Finishes: 605, 605e, 606, 606e, 609, 611, 612, 613, 613e, 616, 619, 620, 626, 629, 630, 693, 722
- Available with Reflections® lever designs. See page 26.
 - Finishes: 605, 606, 611, 612, 612, 613, 619, 626, 629, 630, 722
- Trim ordering example: AU506F x 626 x RHR.
- 1-year limited warranty.

Applications	Nightlatch Access by Key	Exit Only Blank Plate	Nightlatch Access by Key	Classroom/ Storeroom Cylinder Controls Knob	Classroom/ Storeroom Cylinder Controls Thumbturn	Passage	Dummy Trim	Classroom/ Storeroom Cylinder Controls Lever	Passage	Passage or Dummy	Dummy Trim
7200, 7210, 7220, 7250, 7200M(F), 7210M(F), 7220M(F), 7250M(F)	121NL ²	500F	501F ²	502F ¹	503F ¹	504F	505F	506F ¹	507F	508F ¹	509F
ANSI	03	01	03	08/09	11/12	14	02	08/09	16	14/02	02

¹ 09, 12 and Free-Wheeling 02 achieved with simple trim modification at installation.
² Not recommended for use with vertical rod devices.

510F series pull/thumbpiece trim

- Certified ANSI/BHMA A156.3, Grade 1. **BHMA** CERTIFIED
- Trim through-bolts to exit device for strength.
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- Plate Dimensions: 1-5/8" x 15-1/4" x 5/8" (41mm x 387mm x 16mm).
- Pull Dimensions: 6-7/16" (164mm) on centers x 2-1/8" (54mm) projection.

- Accepts rim cylinders. Cylinders not included. See page 42 for cylinder options.
- Finishes: 605, 605e, 606, 606e, 609, 611, 612, 613, 613e, 616, 619, 620, 626, 629, 630, 693, 722
- Trim ordering example: 512F x 630
- 1-year limited warranty.

Applications	Nightlatch Access by Key	Classroom/ Storeroom Cylinder Controls Thumbturn	Dummy Trim	Passage	Classroom/ Storeroom Cylinder Controls T-Piece	Passage
7200, 7210, 7220, 7250, 7200M(F), 7210M(F), 7220M(F), 7250M(F)	512F [^]	513F	514F	517F	518F	519F
ANSI	03	11/12	02	16	05/06	15

[^]Not recommended for use with vertical rod devices.



7200 & 7200M series trims

480F series offset pull trim

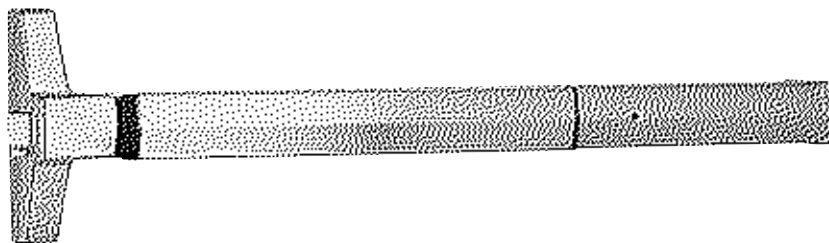
- 1-3/4" (44mm) door standard. For doors through 2-1/4" (57mm) or shim-mounted devices, specify on order.
- Plate Dimensions: 1-3/4" x L x 3/16" (44mm x L x 5mm) L = Overall plate length is 2-1/4" (57mm) longer than pull dimension.
- Pull Dimensions:
 - 480F and 481F trim have a 7-1/4" (184mm) pull length on centers which through-bolts to exit device for strength.
 - 482F and 483F trim have a 9" (229mm) pull length on centers and are not through-bolted to allow pulls of different lengths to be utilized. Longer lengths of 15" (381mm), 18" (457mm) and up to 30" (762mm) are available.
- 2-13/32" (61mm) projection.
- Cylinders not included. See page 42 for cylinder options.
- Finishes: 605, 605e, 606, 606e, 609, 611, 612, 613, 613e, 616, 619, 620, 626, 629, 630, 693, 722
- Trim ordering example: 481F x 630 x LHR
- 1-year limited warranty

Applications	Cylinder	Dummy Pull	Nightlatch Access by Key
7200, 7210, 7220, 7250, 7200M(F), 7210M(F), 7220M(F), 7250M(F)	Rim	480F 482F	481F* 483F*
ANSI	--	02	03

***Not recommended for use with vertical rod exit devices.
For 629 & 630 finishes the escutcheon is nickel plated to match stainless steel.**

7200 RIM

The 7200 is a narrow stile rim exit device compatible with the aesthetics and functional requirements of contemporary doors. The 7200 comes in varied finishes and can be combined with a variety of trims to match any desired style.



CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
ANSI Certified: A156.3, Type 4, Grade 1

BHMA Listed: Directory of Certified Products

FEATURES

- Designed for narrow stile doors
- 3/4" throw deadlocking stainless steel Pullman latch
- Non-handed for easy installation

APPLICATIONS

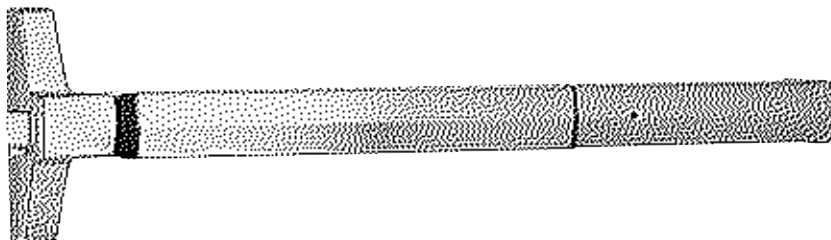
- Single swing narrow stile doors
- Pairs of narrow stile doors with removable mullions
- Metal and aluminum doors
- For panic-rated doors only

SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. 2" (51mm) and 2-1/4" (57mm); specify when ordering.
Minimum Stile Width:	2" (51mm).
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged.
Latchbolt:	3/4" (19mm) deadlocking stainless steel Pullman type.
Strike:	Standard: 759. Optional: 793 (double door applications).
Fasteners:	Machine screws standard for panic hardware.
Trims:	500F/510F Series trim.
Options	Cylinder dogging, Shim Kit # 723NS, Sex Nuts and Bolts.
Warranty:	5-year limited.

7200M(F) RIM

The 7200M(F) rim exit device provides the appearance of a narrow stile rim exit device for use on wide stile or flush doors. Utilizing the 7200M(F) with narrow stile trim provides design continuity and pleasing aesthetics when matching exit devices for inside doors to outside narrow stile doors.



CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(4' x 8' single, 8' x 8' pairs, 3 hr.)

ANSI Certified: A156.3, Type 4, Grade 1
BHMA Listed: Directory of Certified Products

FEATURES

- Narrow stile appearance designed for wide stile or flush doors
- 3/4" throw deadlocking stainless steel pullman latchbolt
- Non-handed for easy installation
- Fully adjustable surface mounted 3/8" diameter roller strike complete with positive locking plate and shims

APPLICATIONS

- Single swing doors
- Pairs of doors with removable mullions
- Metal, wood or composite door materials

SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors. -48 for 36-1/2" - 48" (927 - 1219mm) doors. Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. 2" (51mm) and 2-1/4" (57mm); specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	3/4" (19mm) deadlocking stainless steel Pullman type
Strike:	757 (panic), 757F (fire), 793 optional (double door application)
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	500F/510F Series trim
Options:	Cylinder dogging, Shim Kit # 723NS, Sex Nuts and Bolts
Warranty:	5-year limited

7210 SURFACE VERTICAL ROD

The 7210 is a narrow stile surface vertical rod exit device to be used on narrow stile, aluminum and metal doors where two-point latching is desired.

CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware

ANSI Certified: A156.3 Type 5, Grade 1

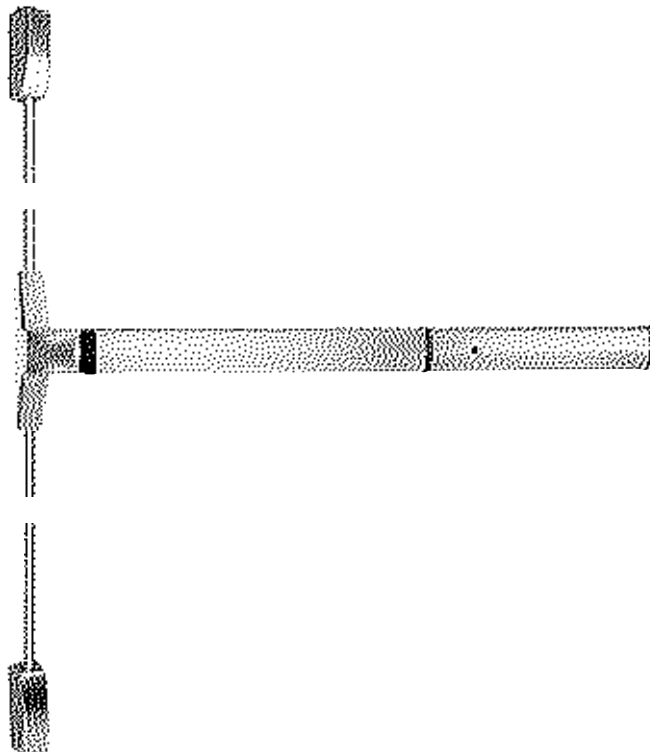
BHMA Listed: Directory of Certified Products

FEATURES

- Designed for narrow stile doors
- Handed. Specify hand (field reversible)
- Bottom deadbolt for secure latching
- Fully adjustable roller strike

APPLICATIONS

- Pairs of narrow stile doors
- Metal and aluminum doors
- For panic-rated doors only



SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height 7'. Optional heights specify suffix -8, -9, -10.
Door Thickness:	1-3/4" (44mm) standard. 2" (51mm) and 2-1/4" (57mm); specify when ordering.
Minimum Stile Width:	2" (51mm).
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged.
Latchbolt:	Top: 3/4" (19mm) stainless steel throw, Pullman-type with automatic deadlatching. Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing.
Vertical Rods:	1/2" (13mm) O.D. tubular brass, bronze or stainless steel with rod guides.
Strike	Top: roller type 791. Bottom: flush mounted 790. 794 floor strike optional (threshold openings).
Fasteners:	Machine screws standard for panic hardware.
Trims:	500F/510F Series trim.
Options:	Cylinder dogging, Shim Kit # 724NS, Sex Nuts and Bolts, -8, -9, -10 opening height, 7010-2, 7010-6, 7010-12 rod extensions, bottom Pullman latch.
Warranty:	5-year limited.

7220 CONCEALED VERTICAL ROD

The 7220 is a narrow stile concealed vertical rod exit device to be used on narrow stile, aluminum and metal doors where two-point latching is desired.

CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware

ANSI Certified: A156.3 Type 5, Grade 1

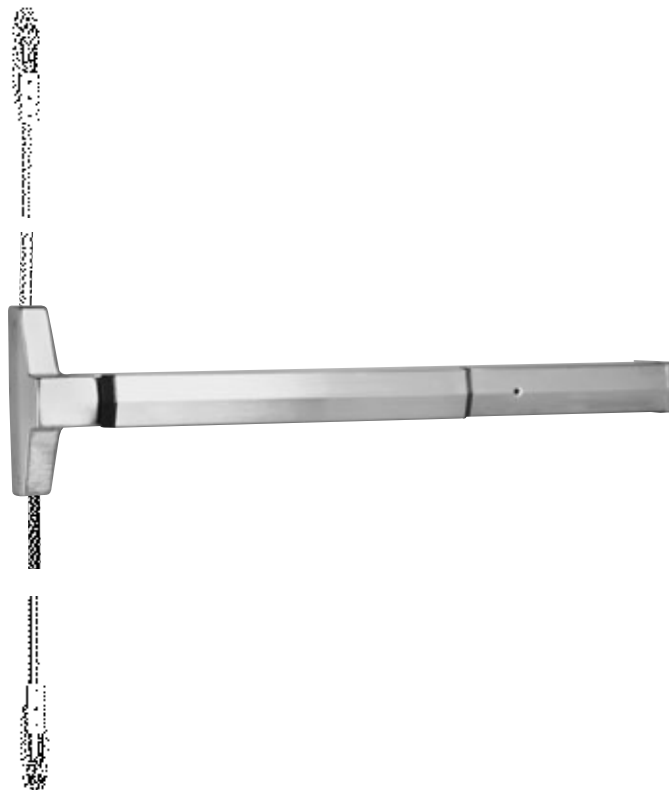
BHMA Listed: Directory of Certified Products

FEATURES

- Designed for narrow stile doors
- Handed. Specify hand (field reversible)
- Bottom deadbolt for secure latching
- Fully adjustable roller strike

APPLICATIONS

- Pairs of narrow stile doors
- Metal and aluminum doors
- For panic-rated doors only



SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height adjustable to 8'. Optional heights specify suffix -9, -10
Door Thickness:	1-3/4" (44mm) standard. 2" (51mm) and 2-1/4" (57mm); specify when ordering.
Minimum Stile Width:	2" (51mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, pullman-type with automatic deadlatching Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing
Vertical Rods:	1/2" (13mm) O.D. telescoping tubular rods
Strike:	Top: roller type 791. Bottom: flush mounted 790. 794 floor strike optional (threshold openings)
Fasteners:	Machine screws and wood door fasteners standard for panic devices.
Trims:	500F/510F Series trim
Options:	Cylinder dogging, Shim Kit # 723NS, Sex Nuts and Bolts, -9, -10 opening height, 7010-2, 7010-6, 7010-12 rod extensions, bottom Pullman latch.
Warranty:	5-year limited

7210M(F) SURFACE VERTICAL ROD

The 7210M(F) is a narrow appearance surface vertical rod exit device to be used on wide stile and flush metal or wood doors where two-point latching is desired.

CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(8' x 8' pairs, 3 hr.)

ANSI Certified: A156.3, Type 5, Grade 1

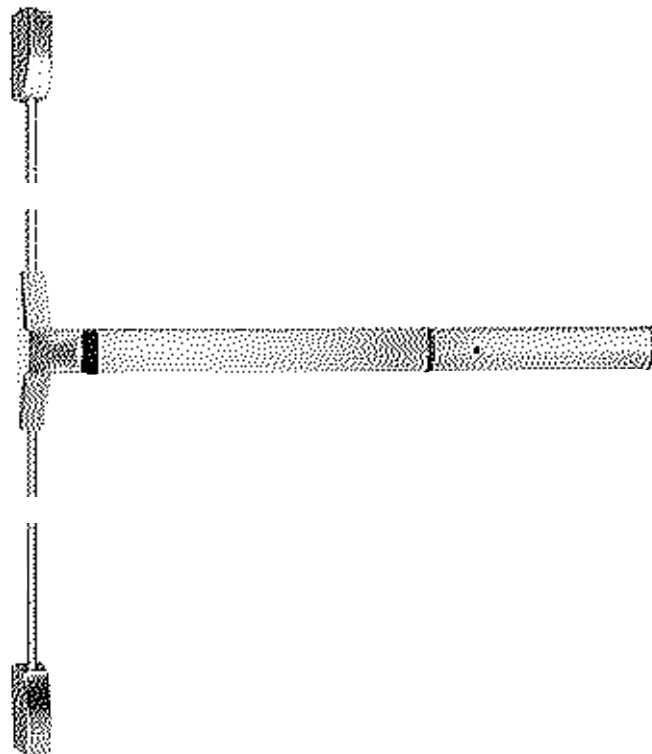
BHMA Listed: Directory of Certified Products

FEATURES

- Narrow stile appearance designed for wide stile doors
- Handed. Specify hand (field reversible)
- Fully adjustable roller strike

APPLICATIONS

- Pairs of doors
- Double egress
- Metal, wood or composite door materials



SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors. -48 for 36-1/2" - 48" (927 - 1219mm) doors. Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height 7'. Optional heights specify suffix -8 (fire and panic), -9, -10 (panic only).
Door Thickness:	1-3/4" (44mm) standard. 2" (51mm) and 2-1/4" (57mm); specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Latchbolt:	Top: 3/4" (19mm) throw, pullman-type with automatic deadlatching. Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing.
Vertical Rods:	1/2" O.D. tubular brass, bronze or stainless steel with rod guides.
Strike:	Top: Roller type 791 (panic and fire). Bottom: Flush mounted 790 (panic and fire). 794 floor strike optional (threshold openings).
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	500F/510F Series trim
Options:	Cylinder dogging, Shim Kit # 724NS, Sex Nuts and Bolts, bottom Pullman latch (panic only), -8, -9, -10 opening height, 7010-2, 7010-6, 7010-12 rod extensions.
Warranty:	5-year limited

7220M(F) CONCEALED VERTICAL ROD

The 7220M(F) is a narrow appearance concealed vertical rod exit device for wide stile and flush metal doors only and is to be utilized where two-point latching is desired.

CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(8' x 8' pairs, 3 hr.)

ANSI Certified: A156.3, Type 8, Grade 1

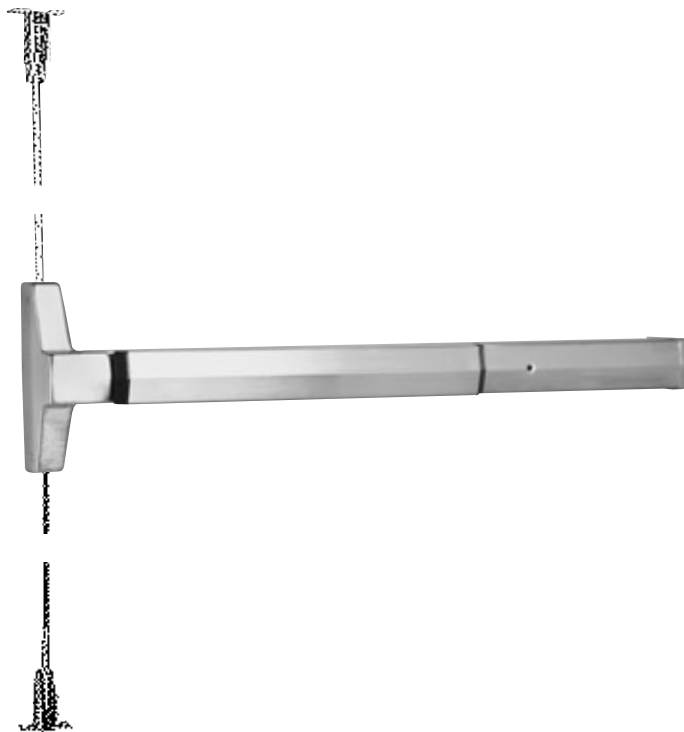
BHMA Listed: Directory of Certified Products

FEATURES

- Narrow stile look designed for wide stile doors
- Handed. Specify hand (field reversible)
- Bottom deadbolt for secure latching
- Fully adjustable roller strike

APPLICATIONS

- Pairs of doors
- Double egress
- Metal doors only

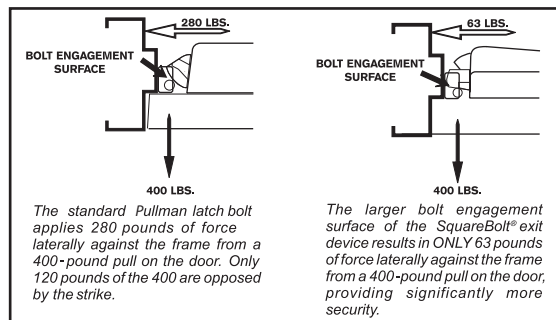
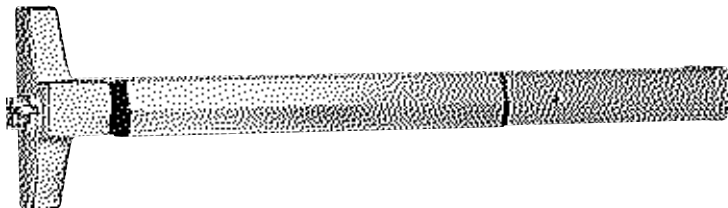


SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors. -48 for 36-1/2" - 48" (927 - 1219mm) doors. Optional sizes can be special ordered. Consult Technical Product Support.
Door Opening Height:	Standard door height adjustable to 8'. Optional heights specify suffix -9, -10 (panic only).
Door Thickness:	1-3/4" (44mm) standard. 2" (51mm) and 2-1/4" (57mm); specify when ordering.
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged.
Latchbolt:	Top: 3/4" (19mm) throw, Pullman-type with automatic deadlatching. Bottom: 5/8" (16mm) throw deadbolt, held retracted during door swing.
Vertical Rods:	1/2" O.D. telescoping tubular rods.
Strike:	Top: Roller strike 791 (panic and fire). Bottom: Flush mounted 790 (panic and fire). 794 floor strike optional (threshold openings)
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	500F/510F Series trim
Options:	Cylinder dogging, Shim Kit # 723NS, Sex Nuts and Bolts, bottom Pullman latch (panic only), -9, -10 opening height, 7010-2, 7010-6, 7010-12 rod extensions.
Warranty:	5-year limited.

7250 SQUAREBOLT®

The unique construction of the *SquareBolt* exit device offers innovative protection. The patented square latchbolt design provides an improved physical barrier over standard Pullman-type rim latchbolts. It locks into place and stays there. Credit cards, crowbars, door rattling and shaking are resisted, significantly reducing the threat of unauthorized entry, especially in applications that include removable mullions. The 7250 *SquareBolt* is designed for narrow stile doors.



CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware

ANSI Certified: A156.3, Type 4 or 28, Grade 1

BHMA Listed: Directory of Certified Products

U.S. Patent #: 5,605,362

FEATURES

- Patented *SquareBolt* security deadbolt (Pat. no. 5,605,362) designed for maximum holding power
- Non-handed for easy installation
- Maintains the look of the Yale® 7200 Series architectural exit devices, allowing for continuity in both design and finish
- Fully adjustable surface mounted 3/8" diameter roller strike complete with positive locking plate and shims
- Used with narrow stile trim

APPLICATIONS

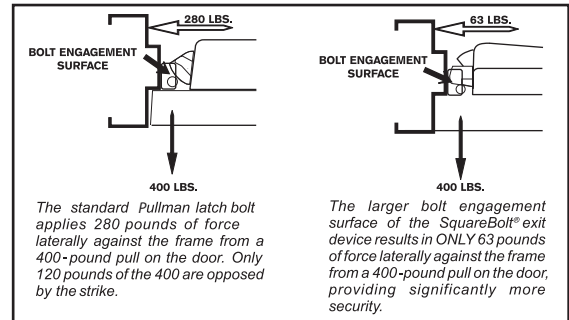
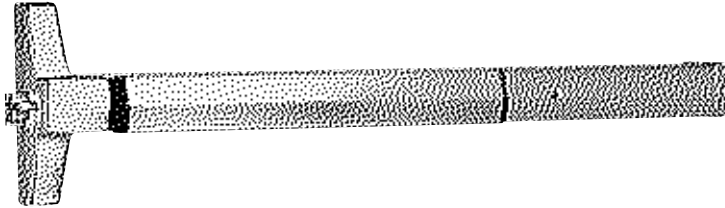
- Single swing narrow stile doors
- Pairs of narrow stile doors with removable mullions
- Metal and aluminum doors
- For panic-rated doors only

SPECIFICATIONS

Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors. -48 for 36-1/2" - 48" (927 - 1219mm) doors. Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. 2" (51mm) and 2-1/4" (57mm); specify when ordering.
Minimum Stile Width:	2" (51mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Deadbolt:	Patented 1" (25mm) slide projection bolt with full 3/4" (19mm) projection
Strike:	Standard: 759. Optional: 793 (double door applications)
Fasteners:	Machine screws standard for panic hardware
Trims:	500F/510F Series trim
Options:	Cylinder dogging, Shim Kit # 723NS, Sex Nuts and Bolts
Warranty:	5-year limited

7250M(F) SQUAREBOLT®

The unique construction of the 7250M(F) *SquareBolt* exit device offers innovative protection while maintaining the appearance of a narrow stile exit device. The patented square latchbolt design provides an improved physical barrier over standard pullman-type latchbolts. The 7250M(F) *SquareBolt* is designed for wide stile or flush doors and provides design continuity of the 7000 Series exit devices.



CERTIFICATION/COMPLIANCE

UL/cUL Listed: FVSR/FVSR7 - Panic hardware
GXHX/GXHX7 - Fire exit hardware (F)
(4' x 8' single, 8' x 8' pairs, 3 hr.)

ANSI Certified: A156.3, Type 4 or 28, Grade 1
BHMA Listed: Directory of Certified Products
U.S. Patent #: 5,605,362

FEATURES

- Patented *SquareBolt* security deadbolt (Pat. no. 5,605,362) designed for maximum holding power
- Non-handed for easy installation
- Maintains the look of the Yale® 7200 Series architectural exit devices, allowing for continuum in both design and finish
- Fully adjustable surface mounted 3/8" diameter roller strike complete with positive locking plate and shims
- Used with narrow stile trim

APPLICATIONS

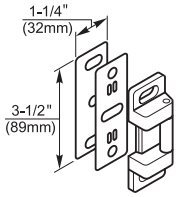
- Single swing doors
- Pairs of doors with removable mullions
- Metal, wood or composite door materials

SPECIFICATIONS

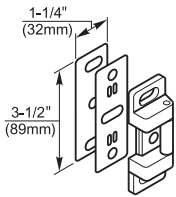
Door Opening Width:	-36 for 30" - 36" (762 - 914mm) doors -48 for 36-1/2" - 48" (927 - 1219mm) doors Optional sizes can be special ordered. Consult Technical Product Support.
Door Thickness:	1-3/4" (44mm) standard. 2" (51mm) and 2-1/4" (57mm); specify when ordering
Minimum Stile Width:	4-1/2" (114mm)
Projection:	3-1/4" (83mm) active, 2-3/4" (70mm) dogged
Deadbolt:	Patented 1" (25mm) slide projection bolt with full 3/4" (19mm) projection
Strike:	757F standard, 793 optional (double door application)
Fasteners:	Machine screws and wood door fasteners standard for panic hardware. Sex nuts and bolts supplied standard for fire exit hardware.
Trims:	500F/510F Series trim
Options:	Cylinder dogging, Shim Kit # 723NS, Sex Nuts and Bolts
Warranty:	5-year limited

STANDARD & OPTIONAL STRIKES

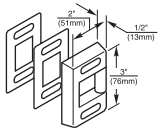
RIM DEVICES



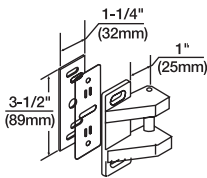
757
Standard 710X,
715X, 720XM



757F
Standard on
7100F, 7150F,
7200MF.



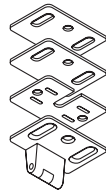
759
Standard 720X



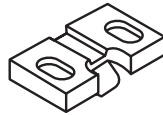
793
Optional strike
for double door
applications.

VERTICAL ROD DEVICES

Top Strikes



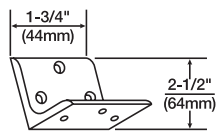
791
Standard top
strike for 711X,
7110F, 712X,
7120F, 721XM,
7210MF, 722XM,
7220MF, 721X,
722X.



726
Standard top
strike for 717X,
7170F.



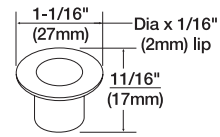
761
Standard top
strike for 716X,
7160F.



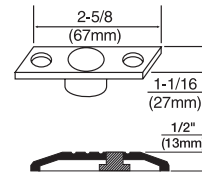
797 Bracket
Optional bracket
for SVR top
strike in flush
transom opening.

VERTICAL ROD DEVICES

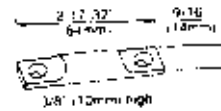
Floor Strikes



790
Standard floor
strike for 711X,
7110F, 712X,
7120F, 717X,
7170F, 716X,
7160F, 721XM,
7210MF,
722XM,
7220MF, 721X,
722X.

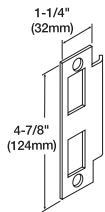


794
Optional floor
strike for fire
openings using
threshold or
flush floor
mount.

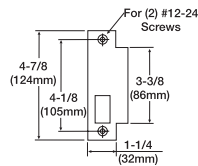


702
Optional floor
strike for
bottom Pullman
latch option.

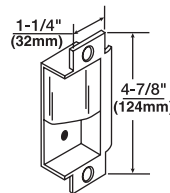
MORTISE DEVICES



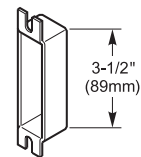
798
Standard on 7130, 7130F



712 Flat ANSI Strike
Optional for door pairs
with astragals (7/8" lip)



718 Open Back Strike
Optional for pairs of
doors where allowed by
door manufacturer

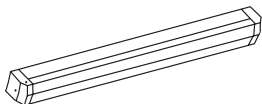


Options
202 Strike box for
ANSI strikes

OPTIONS

720 RIGID BAR

For push-pull vestibule doors leading to doors with 7000 Series exit devices. Bars fit doors up to 48" (1.22m) wide. Same finishes as devices. Specify 720 x finish.



SPECIALTY FASTENERS

Sex nuts, required for wood, composite or unreinforced metal doors.

SN-104, Interlock bracket pack of (4) 10-24 sex nuts for all fire rim and Squarebolt devices.

SN-134, pack of (4) 1/4-20 sex nuts for all devices.

TORX® Security Screws available for factory product orders. Wood screws may only be used in predrilled pilot holes of solid core wood doors.

EXTENSION RODS

Model #	Length
7010-2	2" (51mm)
7010-6	6" (152mm)
7010-12	12" (305mm)

Specify finish.

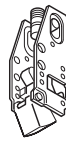
LONG SPINDLE KIT

Long spindle (tailpiece) kit for all series trim, up to 4-1/2" thick doors. Specify part number to order.

Part Number	Door Thickness	Trim Type
7000 Spindle Kit	2" - 2-1/4"	All Trim
81-9500-1633-000	2-1/2" - 3-1/2"	520F, 620F Series Lever & Knob Trim
81-9500-1634-000	3-1/2" - 4-1/2"	520F, 620F Series Lever & Knob Trim
81-9500-1635-000	2-1/2" - 3-1/2"	530F Series Thumbpiece Trim
81-9500-1636-000	3-1/2" - 4-1/2"	530F Series Thumbpiece Trim

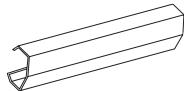
BOTTOM PULLMAN LATCH

Optional bottom Pullman latch available for panic listed vertical rod exit devices. To order, specify "bottom Pullman latch".



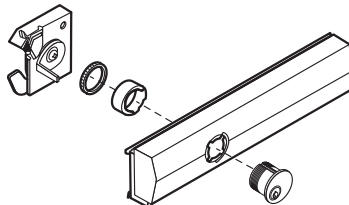
730 36/48 TOUCHPAD SCALP

Field replacement scalp to renew touchpad looks. Specify 730-36 or 730-48 x finish.

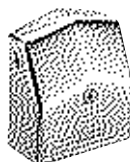


CYLINDER DOGGING

Cylinder dogging is available for all panic-listed exit devices only. Requires use of 1-1/8" mortise cylinder. When ordered with a device, 6-pin 2153 cylinder is supplied standard. (See How to Order, "Fourth Digit", page 47.) Cylinder dogging kit available; specify 715-48 (cylinder not included with this kit).

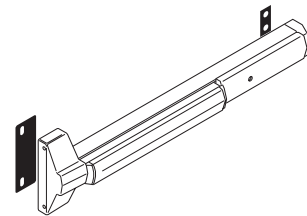


END CAP



The 7000 series impact-resistant end cap is designed with heavy-duty material with three screw holes in strategic locations to resist abuse and maintain functionality. The ECK7 kit is available for easy retrofit to existing exit devices. To order retrofit kit, specify ECK7 x finish.

SHIM KITS



Shim kits, for devices on doors with interfering molding, are available. Each shim kit contains 2 sets of 1/8" thick shims to shim a device 1/8" (3mm) or 1/4" (6mm). Longer device mounting screws (not included) are required for more than 1/4" (6mm) shimming. 693 (Black) finish.

723, Shim Kit for 7100(F) Series Rim, 7150(F) Series SquareBolt®, 7120(F) Series* Concealed Vertical Rod, and 7130(F) Series* Mortise Exit Devices.

723NS, Shim Kit for 7200 Series Rim, 7200M(F) Series Rim, 7250 Series SquareBolt, 7250M(F) Series SquareBolt, 7220 Series* and 7220M(F)* Concealed Vertical Rod Exit Devices.

724, Shim Kit for 7110(F) and 7170(F) Series Surface Vertical Rod Exit Devices.

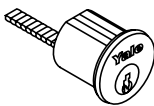
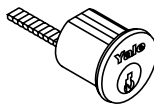
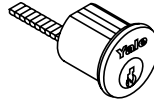
724NS, Shim Kit for 7210(F) Series Surface Vertical Rod Exit Devices.

*Note: Special mortise or concealed vertical rod components needed for openings requiring more than (2) shim kits, or for shimmed mortise devices in doors over 1-3/4" (44mm) thick. Details on application.

LESS BOTTOM ROD


7170(F90) surface and 7160(F90) concealed vertical rod exit devices available less bottom rod. Fire-rated devices supplied standard with a heat-activated door bolt popper. To order, suffix LBR.

CYLINDERS

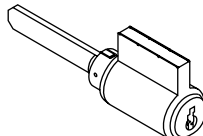
		Application:	Cylinder(s)	Description	Cylinder Ring	Mounting Screws	
Rim Cylinder	Narrow Escutcheon Trim 500F/510F Series Rim cylinders with special # 599 cylinder rings. NOT AVAILABLE with U5109 cylinder.		7200, 7200M, 7200MF Rim	1109 / 5109 6-pin	Standard / Security	599-419	60-7000-1235-048
			7250, 7250M, 7250MF	1109 / 5109 7-pin	Standard / Security	599-419	60-7000-1235-048
			SquareBolt®	1193 / 5193 6-pin	I.C. / Sec. I.C.	599-544	10-1193-1018-048
			7210, 7210M, 7210MF SVR	1193 / 5193 7-pin	I.C. / Sec. I.C.	599-544	10-1193-1018-048
			7220, 7220M, 7220MF CVR	1709 6-pin	CMK Cylinder	599-544	34-2311-8738-048
				1709 7-pin	CMK Cylinder	599-700	34-2311-8738-048
	Standard Escutcheon Trim 520F/530F Series Rim Cylinders		7100(F), 7100(F)-2 Rim	1109 / 5109 6-pin	Standard / Security	1765-250	60-7000-1235-048
			7150(F), 7150(F)-2	U5109 6-pin	High Security	----	60-7000-1235-048
			SquareBolt®	1109 / 5109 7-pin	Standard / Security	1765-250	60-7000-1235-048
			7110(F), 7170(F) SVR	U5109 7-pin	High Security	1766	60-7000-1235-048
			7120(F) CVR	1709 6-pin	CMK Cylinder	1765-656	34-2311-8738-048
				1709 7-pin	CMK Cylinder	1765-656	34-2311-8738-048
	Heavy-Duty Escutcheon Trim 620F and 600 Series Electric Trim Rim Cylinders		7100(F), 7100(F)-2 Rim	1109 / 5109 6-pin	Standard / Security	----	60-7000-1235-048
			7150(F) 7150(F)-2	U5109 6-pin	High Security	----	60-7000-1235-048
			SquareBolt®	1109 / 5109 7-pin	Standard / Security	----	60-7000-1235-048
			7110(F), 7170(F) SVR	U5109 7-pin	High Security	----	60-7000-1235-048
			7120(F), 7160(F) CVR	1709 6-pin	CMK Cylinder	1765-250	34-2311-8738-048
				1709 7-pin	CMK Cylinder	1765-250	34-2311-8738-048
	1193 / 5193 6-pin	Std. / Sec. I.C.	1765-250	10-1193-1018-048			
	1193 / 5193 7-pin	Std. / Sec. I.C.	1765-344	10-1193-1018-048			

Note: Mounting screw part numbers shown are the screws to mount the cylinder.

Note: Same cylinder used for inside and outside on double cylinder exit device..

		Application:	Cylinder(s)	Description	Cylinder Ring	
Mortise Cylinder	Mortise Exit Devices Standard Escutcheon trim 550F/560F Series 	7130(F), 7130(F)-2 Mortise	2153/5153, 6 or 7-pin, 1-1/4" (29mm)	Standard / Security	1765 - .062	As with exit device trim you must order a cylinder to go with a keyed removable mullion. The Yale keyed removable mullion accepts a standard 6-pin 2153 mortise cylinder with cam # 2160. Other cylinders are optional. *U5153 6 and 7-pin cylinders cannot be used with a keyed removable mullion.
			2196 / 5196 6-pin	Std. I.C. / Sec. I.C.	1765 - .344	
			2197 / 5197 7-pin	Std. I.C. / Sec. I.C.	1765 - .531	
			U5153, 6 or 7-pin, 1-1/4" (32mm)	High Security	----	
	Mortise Exit Devices Heavy-Duty Escutcheon Trim 650F Series	7130(F), 7130(F)-2 Mortise	2153 / 5153, 6 or 7-pin, 1-1/2" (38mm)	Standard / Security	----	
			2196 / 5196 6-pin	Std. I.C. / Sec. I.C.	----	
			2197 / 5197 7-pin	Std. I.C. / Sec. I.C.	1765 - .062	
	Keyed Removable Mullions KRM100/100F	7100(F), 7150(F), 7200, 7250, 7200M(F), 7250(F)	2153/5153*, 6 or 7-pin, 1-1/8" (29mm)	Standard / Security	----	
			2196 / 5196 6-pin	Std. I.C. / Sec. I.C.	1765-250	
	Cylinder Dogging	Panic-rated devices	2153, 6-pin, 1-1/8" (29mm)	Standard	----	
2153, 7-pin 1-1/4" (32mm)			Optional 7-pin	1765 - .156		
2196, 6-pin 1-1/2" (38mm)			Std. I.C. 6-pin	1765 - .406		
SecureX® & Alarm Kit	All exit devices	2197, 7-pin 1-11/16" (42mm)	Std. I.C. 7-pin	1765 - .594		

Note: Inside cylinder for double cylinder exit device is 2-3/4" (70mm) length with 1765-.250 ring

		Application:	Cylinder(s)	Description
Knob or Leverset Trim 540F Series Trim Keyed trim uses Yale® cylindrical lock cylinders.		7100(F) Rim 7150(F) SquareBolt 7110(F), 7170(F) SVR 7120(F) CVR	1801	6-pin Knob Cyl. (Std.)
			1802	6-pin Lever Cyl. (Std.)
			1802A	7-pin Lever Cylinder
			1210	6-pin I.C. Lever Cylinder
			1220	7-pin I.C. Lever Cylinder
			5802	6-pin Security Lever Cyl.
			5802A	7-pin Security Lever Cyl.
			5210	6-pin I.C. Security Cyl.
			5220	7-pin I.C. Security Cyl.
			107S	Adaptor kit for Schlage® Cyl.
			"B" Trim Prefix	Trim with lever for Best®, Arrow® or Falcon® IC cylinder (specify 6 or 7-pin)
			"R" Trim Prefix*	Trim with lever for Corbin Russwin IC cylinder

*AU & PB levers only.

Yale®
KeyMark® Refer to separate catalog section for availability.

FUNCTIONS

KNOB OR LEVER TRIMS

SquareBolt® 7150(F) 7250M(F) 7250		Rim 7100(F) 7200M(F) 7200		Surface Vertical Rod 7110(F) 7170(F90) 7210M(F) 7210		Concealed Vertical Rod 7120(F) 7160(F90) 7220M(F) 7220		Mortise 7130(F)		Type	ANSI Function No.	Function Description
Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside			
										Exit Only/ Blank Plate	01 –	Exit only, no trim. Exit only, blank plate.
										Dummy	02	Entrance by trim when actuating bar is locked down.
										Nightlatch	03	Entrance by trim when latchbolt is retracted by key. Key removable only when locked.
										Classroom	08	Entrance by knob or lever. Key locks or unlocks knob or lever.
										Storeroom	09	Entrance by knob or lever only when released by key. Key removable only when locked.
										Passage	14	Entrance by trim when latchbolt is released by knob or lever. Knob or lever always active, no cylinder.

















































































Note: 09 and Free-Wheeling 02 achieved with a single modification at installation.

DOUBLE CYLINDER EXIT DEVICE LEVER TRIMS

SquareBolt® 7150(F)-2		Rim 7100(F)-2		Mortise 7130(F)-2		Type	ANSI Function No.	Function Description
Inside	Outside	Inside	Outside	Inside	Outside			
						Classroom	08	Entrance by lever. Key either side locks or unlocks lever.

FUNCTIONS

THUMBPIECE, THUMBTURN AND PULL TRIMS

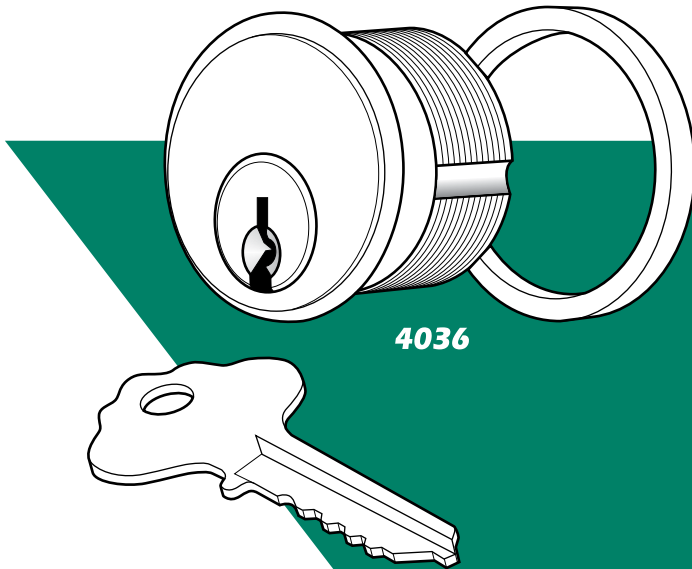
SquareBolt® 7150(F) 7250M(F) 7250		Rim 7100(F) 7200M(F) 7200		Surface Vertical Rod 7110(F) 7170(F90) 7210M(F) 7210		Concealed Vertical Rod 7120(F) 7160(F90) 7220M(F) 7220		Mortise 7130(F)		Type	ANSI Function No.	Function Description
Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside			
										Exit Only/ Blank Plate	01 –	Exit only, no trim. Exit only, blank plate.
										Dummy/ Pull Plate	02	Entrance by trim when actuating bar is locked down.
										Nightlatch	03	Entrance by trim when latchbolt is retracted by key. Key removable only when locked.
										Classroom	05	Entrance by thumbpiece. Key locks or unlocks thumbpiece.
										Storeroom	06	Entrance by thumbpiece only when released by key. Key removable only when locked.
										Passage	15	Entrance by trim when latch is released by thumbpiece. Thumbpiece is always active, no cylinder.
										Classroom	11	Entrance by control turn piece. Key locks or unlocks control.
										Storeroom	12	Entrance by control turn piece only when released by turning key. Key removable only when locked.

Note: 06 and 12 achieved with a single modification at installation.

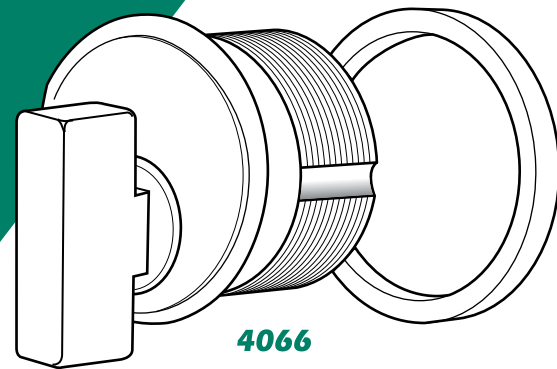
Mortise Cylinder & Thumbturn

4036 - Cylinder 4066 - Thumbturn

ANSI/BHMA Type E19211 (Grade 1)



4036



4066

▼ Shell, Cylinder

Brass, Aluminum scalp with US28 Clear Anodized (628) or 313 (Dark Bronze Anod.) or 335 (Black Anod.). Plug is US26 Chrome (625).

▼ Keying

Available in keyed-alike pairs (KA2), keyed-different (KD) and keyed-alike sets of 50 (KA50). All cylinders furnished with two keys per cylinder.

▼ Trim Ring

Furnished. 1/4" thick, suitable for 1-3/4" thick doors. Available on special order for other door thicknesses.

▼ Function

A standard 1-5/32" diameter cylinder with 5-pin tumbler security. Designed to operate any Adams Rite lock or latch requiring a mortise cylinder. Close-tolerance manufacture and inspection achieve setscrew grooves and cam that are true on their respective centerlines. This ensures proper mating and operation with the lock or latch mechanism.

▼ Shell, Turn

Brass. Choice of three finishes: 130 to match Clear Anodized, 313 (Dark Bronze Anodized) or 335 (Black Anodized).

▼ Trim Ring

Furnished. 1/4" thick, suitable for 1-3/4" thick doors. Available on special order for other door thicknesses.

▼ Function

To operate lock or latch without key. Interchanges with standard 1-5/32" diameter mortise cylinder. Cams are available to suit the particular Adams Rite lock or latch. (See back for cam specifications.)

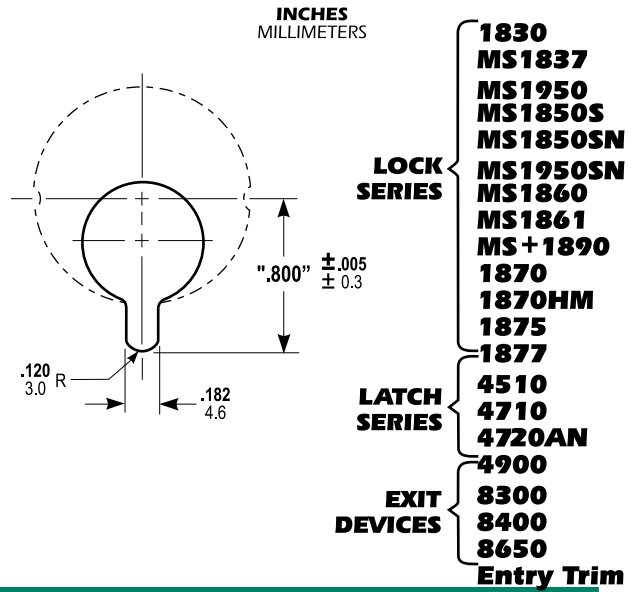


4036 Mortise Cylinder/4066 Thumbturn

CYLINDERS "BY OTHERS"

Adams Rite metal stile glass door deadbolts and latches are designed to accept standard 1-5/32" mortise cylinders of all popular makes. This means that the entrance can be keyed to match the system used throughout the building on other types of doors. Care must be taken, however, to specify the proper cam for each type of lock, as these are not generally interchangeable. The cam shapes shown below are available from the listed cylinder manufacturers and will be supplied by them with the cylinder when specified or available separately. Because of variations in attachment of cams to cylinders and other construction differences, it is advisable NOT to attempt using one manufacturer's cylinder with another's cam.

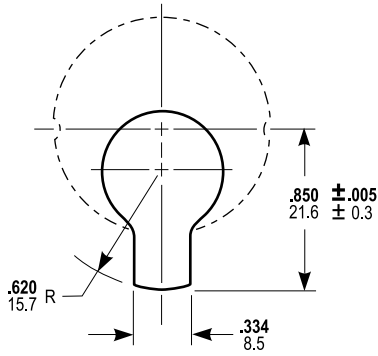
Dimensions of Cam to Operate:



MS® CAM

Manufacturer	Standard	High Security	IC/Removable Core
Arrow	AR18	18A	18C/18A
Best	N/A	N/A	C181
Corbin-Russ.	111F55	111F55	362F42
Falcon	9899	9899	A12667-001
ILCO	863A	863A	863A
Medeco	Z02	Z02	Z02
Sargent	13-0512	18-0076	13-0832
Schlage	B502-292	B502-944	K510-711
Yale	1161L	1161L	1160L

Dimensions of Cam to Operate: 4070 Series Deadlock

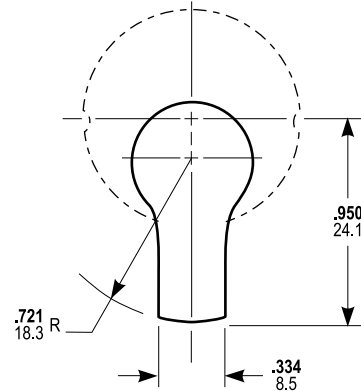


This cam available from above cylinder manufacturers on special order (or make from standard cam)

4070 CAM

Manufacturer	Standard	High Security	IC/Removable Core
Arrow	N/A	N/A	N/A
Best	N/A	N/A	A-4445
Corbin-Russ.	105F70	105F70	423F49
Falcon	A09898-000	A09898-000	A12667-002
ILCO	863H	863H	863H
Medeco	Z06	Z06	Z06
Sargent	13-0513	N/A	N/A
Schlage	B502-380	B502-945	B520-378
Yale	N/A	N/A	N/A

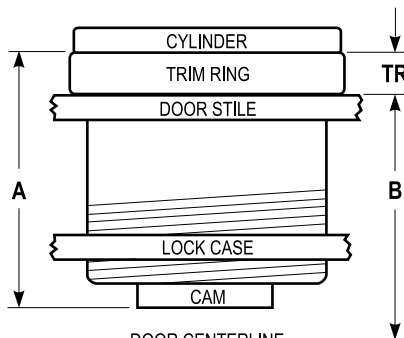
Dimensions of Cam to Operate: 2331 Series Deadlock



This cam available from all cylinder manufacturers (standard cam)

2331 CAM

Manufacturer	Standard	High Security	IC/Removable Core
Arrow	001	1A	1C
Best	N/A	N/A	A-1248
Corbin-Russ.	65F36	N/A	N/A
Falcon	9897-000-30	9897-000-30	12667-003-50
ILCO	863G	863G	863G
Medeco	Z01	Z01	Z01
Sargent	13-0097	18-0080	X1-3000
Schlage	B502-191	B502-948	K510-730
Yale	1161	1161	1160E



Cylinder Trim Ring for Narrow Stiles

Narrow stile doors require a trim ring to fill the gap remaining between the cylinder shoulder and stile when a standard mortise cylinder is used. If the security of the hardened steel Adams Rite MS4043 Cylinder Guard is not required, this ring may be simply a length of 1.171 I.D. tubing. Its length varies depending on door thickness or cylinder make and number of pins. The specific length required can be quickly determined by the following formula:

FOR MS® LOCKS:

$$TR^* = A + .125 - B$$

FOR 2190

$$TR^* = A - B$$

FOR 4500 SERIES LATCHES:

$$TR^* = A + .0312 - B$$

*TOLERANCE: ±.060

4036/4066 OPTIONS

Dash number specifies type of cam:
-01 for MS lock, 4900 Deadlatches, etc.
-02 for 4070 Deadbolt
-03 for 2331 Deadbolt

STANDARD PACKAGE

Individually packed with trim ring. 4036 also furnished with key.

4036 Mortise Cylinder

4066 Thumbturn



4036



4066

The 4036 Mortise Cylinder provides five-pin security with most Adams Rite deadlocks or deadlatches. The 4066 Thumbturn operates deadlocks or deadlatches without a key.

Function

4036

A standard 1" [25.4 mm] length, 1-5/32" [29.4 mm] diameter cylinder with five-pin tumbler security. Designed to operate any Adams Rite deadlock or deadlatch requiring a mortise cylinder. Close tolerance manufacturing achieve set screw grooves and cam geometry that are true on their respective center lines. This ensures proper mating and operation with the locking or latching mechanism. Select cam to suit particular Adams Rite deadlock or deadlatch.

4066

To operate deadlock or deadlatch without key. Interchanges with standard 1" [25.4 mm] length, 1-5/32" [29.4 mm] diameter mortise cylinder. Cams are available to suit the particular Adams Rite deadlock or deadlatch. See next page for cam specifications.

Features

Shell

4036: Aluminum with 313 Dark bronze anodized, 335 Black anodized, 628 Clear anodized finish. Plug is US26 (625) Bright chrome.

4066: Choice of three finishes: 130 to match 628 Clear anodized, 313 Dark bronze anodized, 335 Black anodized.

Trim Ring

Furnished. 1/4" [6.4 mm] thick, suitable for 1-3/4" [44.5 mm] thick doors. Available by special order for other door thicknesses.

Keying

All cylinders furnished with two keys per cylinder. Available in keyed different (KD), or keyed alike pairs (KA2). Keyed alike 50 are available

by special order in quantity of 50 cylinders only. Please contact factory for ordering information.

Standard Package

Individually packed with trim ring. 4036 furnished with keys.

Shipping Weight

1/2 lb [0.23kg]

Cylinder by Others

Adams Rite deadlocks and deadlatches are designed to accept standard 1" [25.4 mm] length, 1-5/32" [29.4 mm] diameter mortise cylinders of all popular makes. This means that the entrance can be keyed to match the system used throughout the building on other types of doors. Care must be taken, however, to specify the proper cam for each type of lock, as these are not generally interchangeable. The cam shapes shown are available from the listed cylinder manufacturers and will be supplied by them with the cylinder when specified or available separately. Because of variations in the attachment of cams to cylinders and other construction differences, it is advisable to NOT attempt using one manufacturer's cylinder with another manufacturer's cam.

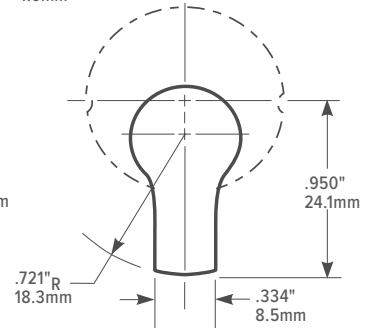
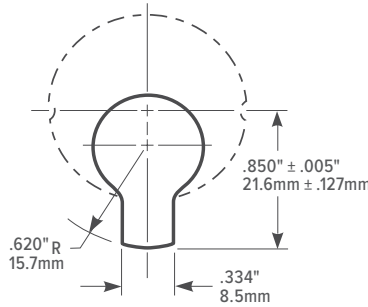
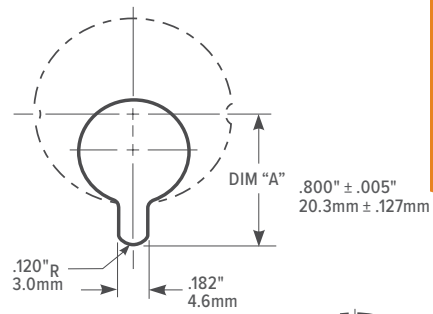
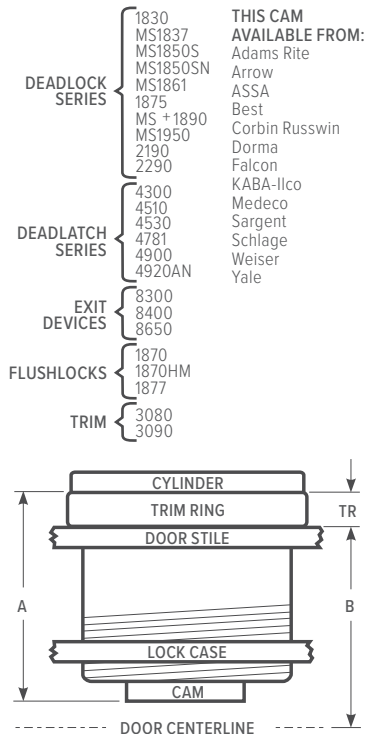


Aluminium

Hollow
Metal

Wood

Dimensions



DIMENSIONS OF CAM TO OPERATE:
4070 SERIES DEADBOLT
This cam available from above cylinder manufacturers on special order

DIMENSIONS OF CAM TO OPERATE:
2331 DEADBOLT
This cam available from all cylinder manufacturers (standard cam)

CYLINDER TRIM RING FOR NARROW STILES

Narrow stile doors require a trim ring to fill the gap remaining between the cylinder shoulder and stile when a standard mortise cylinder is used. If the security of the hardened steel Adams Rite MS4043 Cylinder Guard is not required, this ring may be simply a length of 1.171 I.D. tubing. Its length varies depending on door thickness or cylinder make and number of pins. The specific length required can be quickly determined by the following formula:

FOR MS® LOCKS:
 $TR^* = A + .125 - B$

FOR 4500 SERIES LATCHES:
 $TR^* = A + .132 - B$

*TOLERANCE: ± .060
FOR 2190 TR* = A - B

"TR" is trim ring length.
"A" is cylinder height (less shoulder but including cam).
"B" is one-half of door thickness.

How to Order & Compatible Products

4036 Mortise Cylinder: Specify quantity and the following information. Order related products separately.

MODEL	LOCK TYPE	KEY OPTIONS*	FINISH
4036	-01	-01	-628
	01 For MS® Lock, 4900 Deadlatches, 2190	01 Keyed different	313 Dark Bronze Anodized
	02 For 4070 Deadlock	02 Keyed alike in pairs	335 Black Anodized
	03 For 2331 Deadlock		628 Clear Anodized

*Keyed alike 50 are available by special order in quantity of 50 cylinders only. Please contact factory for ordering information.

4066 Thumbturn: Specify quantity and the following information. Order related products separately.

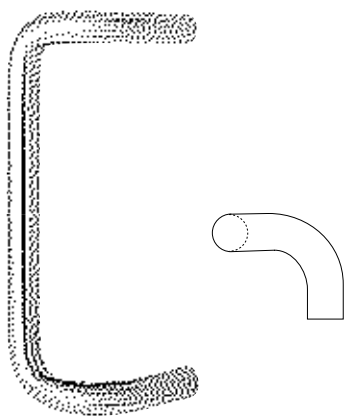
MODEL	LOCK TYPE	FINISH
4066	-01	-130
	01 For MS® Lock, 4900 Deadlatches	130 To match 628 Clear Anodized
	02 For 4070 Deadlock	313 Dark Bronze Anodized
	03 For 2331 Deadlock	335 Black Anodized

COMPATIBLE

DEADLOCKS	DEADLATCHES	FLUSHLOCKS	EXIT DEVICES	TRIM
1830, MS1837, MS1850S, MS1850S-050, MS1850SN, MS1850SN-050, MS1861, 1875, MS+1890, MS1950, MS1950-050, 2190, 2290 Series Deadlocks	4300 Electrified Deadlatches, 4510, 4530, 4900, 4920AN Series Deadlatches 4781 Two Point Deadlatch (4036 only)	1870, 1870HM, 1877 Series Cylinder-Operated Flushbolts	8300, 8400 Mortise Exit Devices, 8500, 8600 CVR Exit Devices w/8650 Cylinder Escutcheon	3080, 3080E Series Entry Trim, 3090-150, A100 Series Keyless Entry

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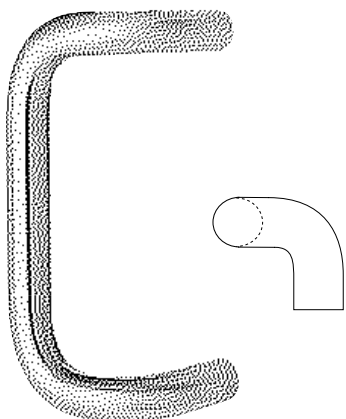




90° Offset Door Pulls No. BF150, BF151, BF152

- Material:** Aluminum, brass, bronze, stainless steel
- Finishes:** Available in standard architectural finishes, US32DMS, US32D316, US32316, white (WPC), red (RPC), and black (BPC) powder coat finishes (see page 9)
- Fastener:** 1/4-20 x 2 1/4" thru bolt & finish washer (standard 1 3/4" door)
- Options:**
- Back to back mounting in pairs — use BTB suffix and mounting type number (BF150BTB16)
 - Concealed mounting single pulls — use C suffix and mounting type number (BF150C17)
 - Advise if door thickness is other than 1 3/4"
 - See page B27 for mounting selection (standard duty 1/4 - 20)

No.	Material Size	CTC	Overall	Base	Projection	Clearance	Offset	Weight	ANSI A156.6
BF150	3/4" dia.	8"	8 3/4"	3/4"	3 1/4"	2 1/2"	4"	2.3 lbs.	J402
BF151	3/4" dia.	10"	10 3/4"	3/4"	3 1/4"	2 1/2"	4"	2.5 lbs.	J402
BF152	3/4" dia.	12"	12 3/4"	3/4"	3 1/4"	2 1/2"	4"	2.7 lbs	J402



90° Offset Door Pulls No. BF156, BF157A, BF157, BF158, BF159

- Material:** Aluminum, brass, bronze, stainless steel
- Finishes:** Available in standard architectural finishes, US32DMS, US32D316, US32316, white (WPC), red (RPC), and black (BPC) powder coat finishes (see page 9).
*US3LIFETIME available on select product below
- Fastener:** 1/4-20 x 2 1/4" thru bolt & finish washer (standard 1 3/4" door)
- Features:** Recommended for ADA openings
- Options:**
- Back to back mounting in pairs — use BTB suffix and mounting type number (BF156BTB16)
 - Concealed mounting single pulls — use C suffix and mounting type number (BF156C17)
 - Advise if door thickness is other than 1 3/4"
 - Heavy duty versions of most fastening types available — use suffix HD to fastening type number (BF156BTB16HD)
 - See page B27 for mounting selection (standard duty 1/4 - 20)

No.	Material Size	CTC	Overall	Base	Projection	Clearance	Offset	Weight	ANSI A156.6
BF156	1" dia.	8"	9"	1"	3 1/2"	2 1/2"	4"	3.9 lbs.	J402
BF157A	1" dia.	9"	10"	1"	3 1/2"	2 1/2"	4"	4.1 lbs.	J402
BF157*	1" dia.	10"	11"	1"	3 1/2"	2 1/2"	4"	4.3 lbs.	J402
BF158	1" dia.	12"	13"	1"	3 1/2"	2 1/2"	4"	4.8 lbs.	J402
BF159	1" dia.	18"	19"	1"	3 1/2"	2 1/2"	4"	6.5 lbs.	J402

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Vandal Resistant Trim No. VRT14, VRT16, VRT24, VRT26



No. VRT14



No. VRT16



No. VRT24



No. VRT26

Material: Stainless Steel

Finishes: US32D

Fastener: 1/4 -20 Thru Bolt. Other sizes to match locks and exit devices as required

- Features:**
- Ideal pull for the exterior doors on schools and other public buildings, as well as the rear exit doors of commercial and industrial buildings
 - Vandal Resistant design minimizes opportunity for tampering
 - No exposed fasteners
 - Supplied with thru bolts for non-integrated mounting or can be supplied with mounting points to mate with exit device or mortise lock
 - US Patent No.: D659,507S

- Options:**
- Cut for cylinder use C suffix (VRT24C) when ordering
 - Specify make and model number of exit device when mounting with exit device fastening systems

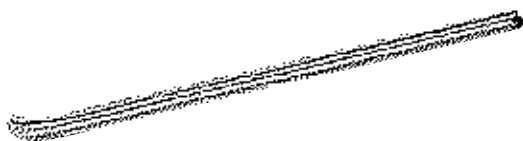
No.	Integral Latch Guard	Textured Black Grip	Overall	Weight
VRT14	Yes	No	1/8" x 7" x 12"	3.2 lbs.
VRT16	No	No	1/8" x 5 1/2" x 12"	2.5 lbs.
VRT24	Yes	Yes	1/8" x 7" x 12"	3.2 lbs.
VRT26	No	Yes	1/8" x 5 1/2" x 12"	2.5 lbs.

Required Order Information (Please supply all required templates).

Quantity	Product #	Mating Manufacturer	Part #	Device Template #	Template # for Cylinder Hole Location	Cylinder Diameter	Door Handing	Single of Pair	Finish

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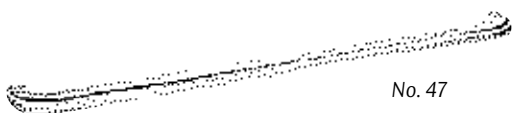
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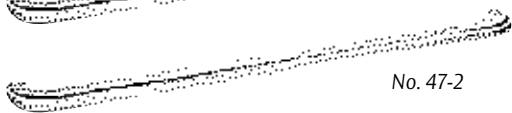
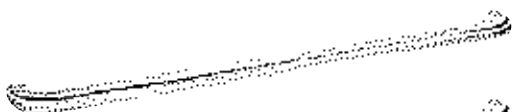
Series 47 Push Bar No. SP47

- Material:** Aluminum, brass, bronze, stainless steel
- Finishes:** Available in standard architectural finishes; US32DMS, US32D316, US32316, white (WPC), red (RPC), and black (BPC) powder coat finishes (see page 9)
- Mounting:** Metal and wood door: type 1, 1/4 - 20x2 1/4" thru bolt and finish washer (standard 1 3/4" door)
NOTE: See page A10 for detailed mounting drawings
- Ordering:** Specify CTC, handing, door type, and finish
- Options:**
- Engraving "PUSH" or "PULL"
 - Advise if door thickness is other than 1 3/4"

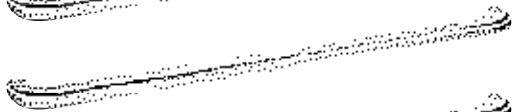
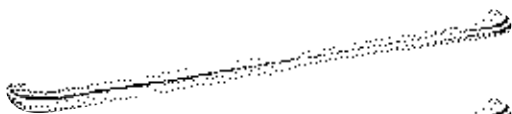
No.	CTC	Material Size	Base	Projection	Clearance	Weight	ANSI 156.6
SP47	Specify	1" dia.	1" dia.	2 1/2"	1 1/2"	8.5 lbs.	J501



No. 47



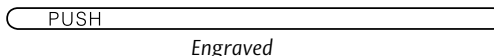
No. 47-2



No. 47-3

Series 47 Push Bar No. 47, 47-2, 47-3, 48

- Material:** Aluminum, brass, bronze, stainless steel
- Finishes:** Available in standard architectural finishes, US32DMS, US32D316, US32316, US3LIFETIME, white (WPC), red (RPC), and black (BPC) powder coat finishes (see page 9)
- Mounting:**
- No. 47, 47-2, 47-3:**
Metal and wood door: type 1, 1/4 - 20x2 1/4" thru bolt and finish washer (standard 1 3/4" door)
Metal door: type 6, concealed, 1/4 - 20 CH MS
- No. 48 (not shown):**
Metal and wood door: type 1, 1/4 - 20x2 1/4" thru bolt and finish washer (standard 1 3/4" door)
NOTE: See page A10 for detailed mounting drawings
- Ordering:** Specify CTC, door type, mounting, and finish
- Options:**
- Engraving "PUSH" or "PULL". Specify handing
 - Heavy duty versions of most fastening types available — use suffix HD to fastening type number (47 Type 6HD)
 - Advise if door thickness is other than 1 3/4"



No.	CTC	Material Size	Base	Projection	Clearance	Weight	ANSI 156.6
47	Specify	1" dia.	1" dia.	2 1/2"	1 1/2"	8.5 lbs.	J501
47-2	Specify	1" dia.	1" dia.	2 1/2"	1 1/2"	17.0 lbs.	J501
47-3	Specify	1" dia.	1" dia.	2 1/2"	1 1/2"	25.5 lbs.	J501
48	Specify	3/4" dia.	3/4" dia.	2 1/2"	1 1/2"	4.5 lbs.	J501

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Door Pulls No. 102, 105, 106, 107, 108, 109

- Material:** Aluminum, brass, bronze, stainless steel
- Finishes:** Available in standard architectural finishes, US32DMS, US32D316, US32316, white (WPC), red (RPC), and black (BPC) powder coat finishes (see page 9). *US3LIFETIME available on select product below
- Fastener:** 1/4-20 x 2 1/4" thru bolt & finish washer (standard 1 3/4" door)
- Options:**
- Back to back mounting in pairs — use BTB suffix and mounting type number (107BTB5)
 - Concealed mounting single pulls — use C suffix and mounting type number (107C6)
 - Advise if door thickness is other than 1 3/4"
 - See page B13 for mounting selection (standard duty 1/4-20)
 - 2 1/2" Barrier Free clearance — use BF prefix (BF107)

No.	Material Size	CTC	Overall	Base	Projection	Clearance	Weight	ANSI A156.6
102	5/8" dia.	5 1/2"	6 1/8"	5/8"	2"	1 3/8"	0.6 lbs.	—
105	3/4" dia.	5 1/2"	6 1/4"	3/4"	2 5/8"	1 7/8"	1.2 lbs.	J401
106	3/4" dia.	6"	6 3/4"	3/4"	2 5/8"	1 7/8"	1.3 lbs.	J401
107*	3/4" dia.	8"	8 3/4"	3/4"	2 5/8"	1 7/8"	1.6 lbs.	J401
108	3/4" dia.	10"	10 3/4"	3/4"	2 5/8"	1 7/8"	1.8 lbs.	J401
109	3/4" dia.	12"	12 3/4"	3/4"	2 5/8"	1 7/8"	2.1 lbs.	J401



Door Pulls No. 110, 111A, 111, 112, 118

- Material:** Aluminum, brass, bronze, stainless steel
- Finishes:** Available in standard architectural finishes, US32DMS, US32D316, US32316, white (WPC), red (RPC), and black (BPC) powder coat finishes (see page 9). *US3LIFETIME available on select product below
- Fastener:** 1/4-20 x 2 1/4" thru bolt & finish washer (standard 1 3/4" door)
- Options:**
- Back to back mounting in pairs — use BTB suffix and mounting type number (112BTB5)
 - Concealed mounting single pulls — use C suffix and mounting type number (112C6)
 - Advise if door thickness is other than 1 3/4"
 - Heavy duty versions of most fastening types available – use suffix HD to fastening type number (112BTB5HD)
 - See page B13 for mounting selection (standard duty 1/4-20)
 - 2 1/2" Barrier Free clearance — use BF prefix (BF110)

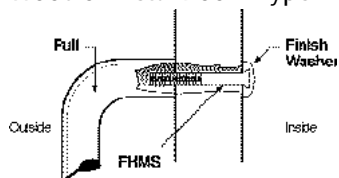
No.	Material Size	CTC	Overall	Base	Projection	Clearance	Weight	ANSI A156.6
110	1" dia.	8"	9"	1"	3"	2"	3.0 lbs.	J401
111A	1" dia.	9"	10"	1"	3"	2"	3.3 lbs.	J401
111*	1" dia.	10"	11"	1"	3"	2"	3.5 lbs.	J401
112*	1" dia.	12"	13"	1"	3"	2"	4.0 lbs.	J401
118	1" dia.	18"	19"	1"	3"	2"	5.4 lbs.	J401

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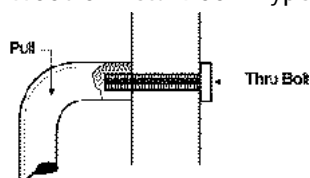
Thru Bolt

Wood or Metal Door – Type 1



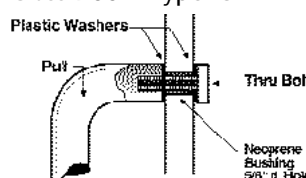
Type	Bolt Size	Drill Size	
		Wood	Metal
1	1/4 - 20	9/32	9/32
1HD	5/16 - 18	1 1/32	1 1/32
1XHD	3/8 - 16	1 1/32	1 1/32

Wood or Metal Door – Type 12



Type	Bolt Size	Drill Size	
		Wood	Metal
12	1/4 - 20	9/32	9/32
12HD	5/16 - 18	1 1/32	1 1/32
12XHD	3/8 - 16	1 1/32	1 1/32

Glass Door – Type 15

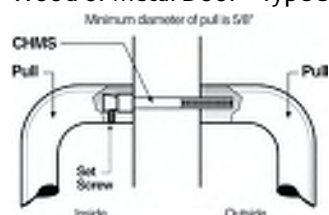


Type	Bolt Size	Drill Size	
		Wood	Metal
15	1/4 - 20	5/8	
15HD	5/16 - 18	5/8	
15XHD	3/8 - 16	5/8	

NOTE: Heavy Duty (HD/XHD) mounting features hex drive for positive tightening and large overall size for superior strength. Recommended for high frequency and rough service openings.

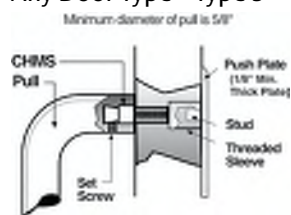
Back to Back

Wood or Metal Door – Type 5



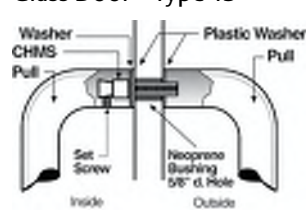
Type	Bolt Size	Drill Size	
		Wood	Metal
5	1/4 - 20	9/32	9/32
5HD	5/16 - 18	1 1/32	1 1/32

Any Door Type – Type 9



Type	Bolt Size	Drill Size	
		Wood	Metal
9	1/4 - 20	N/A	

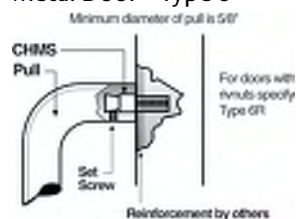
Glass Door – Type 13



Type	Bolt Size	Drill Size	
		Wood	Metal
13	1/4 - 20	5/8	
13HD	5/16 - 18	5/8	

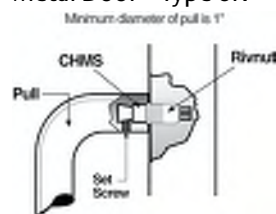
Surface Concealed

Metal Door – Type 6



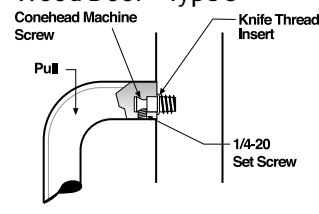
Type	Bolt Size	Drill Size	
		Wood	Metal
6	1/4 - 20	1/4 - 20 tap	
6HD	5/16 - 18	5/16 - 18 tap	

Metal Door – Type 6R



Type	Bolt Size	Drill Size	
		Wood	Metal
6R	1/4 - 20	N/A	

Wood Door – Type 8

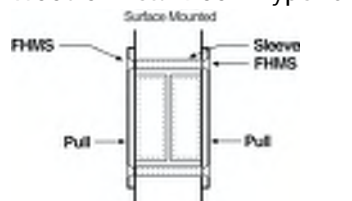


Type	Bolt Size	Drill Size	
		Wood	Metal
8	1/4 - 20	23/64 X 9/16 dp	
8HD	5/16 - 18	7/16 X 9/16 dp	

Flush Pull Mounting

Type 10 Mounting applies to the 94 Series Flush Pulls

Wood or Metal Door – Type 10

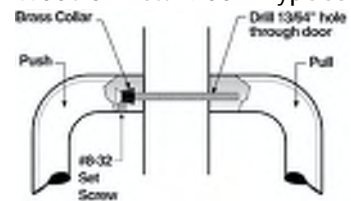


Type	Bolt Size	Drill Size	
		Wood	Metal
10	8 - 32	9/32	9/32

Wire or Small PostMount Pull Mounting

NOTE: This mounting should only be used on pulls with mounting points that are 1/2\"/>

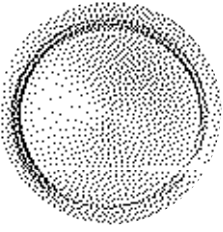
Wood or Metal Door – Type 55



Type	Bolt Size	Drill Size	
		Wood	Metal
55	8 - 32	13/64	13/64

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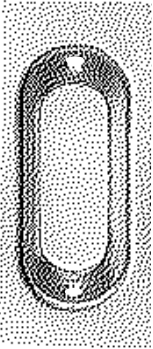
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Flush Cup Pull No. 860

- Material:** Brass, stainless steel
Finishes: US3, US10B, US32D
Fastener: 2 ea. #4 x 5/8" OH WS
Other: See website for installation template

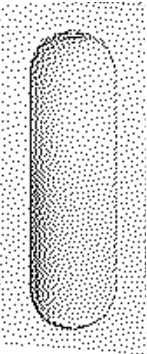
No.	Size	Weight	ANSI A156.14
860	2 1/2" dia.	0.9 lbs./10	B02201



Wrought Flush Pull No. 870

- Material:** Brass, stainless steel
Finishes: US3, US10B, US32D
Fastener: 2 ea. #4 x 5/8" OH WS

No.	Size	Weight	ANSI A156.14
870	1 3/8" x 3 3/16"	0.5 lbs./10	D0781



Cast Flush Pull No. 872

- Material:** Cast brass
Finishes: US3, US10B, US26D, other finishes available upon request
Fastener: 2 ea. #4 x 5/8" OH WS

No.	Size	Weight	ANSI A156.14
872	1 5/16" x 3 1/8"	0.2 lbs.	D0781

Locking Pull System

SIMPLE. DURABLE. BEAUTIFUL.

ROCKWOOD[®]

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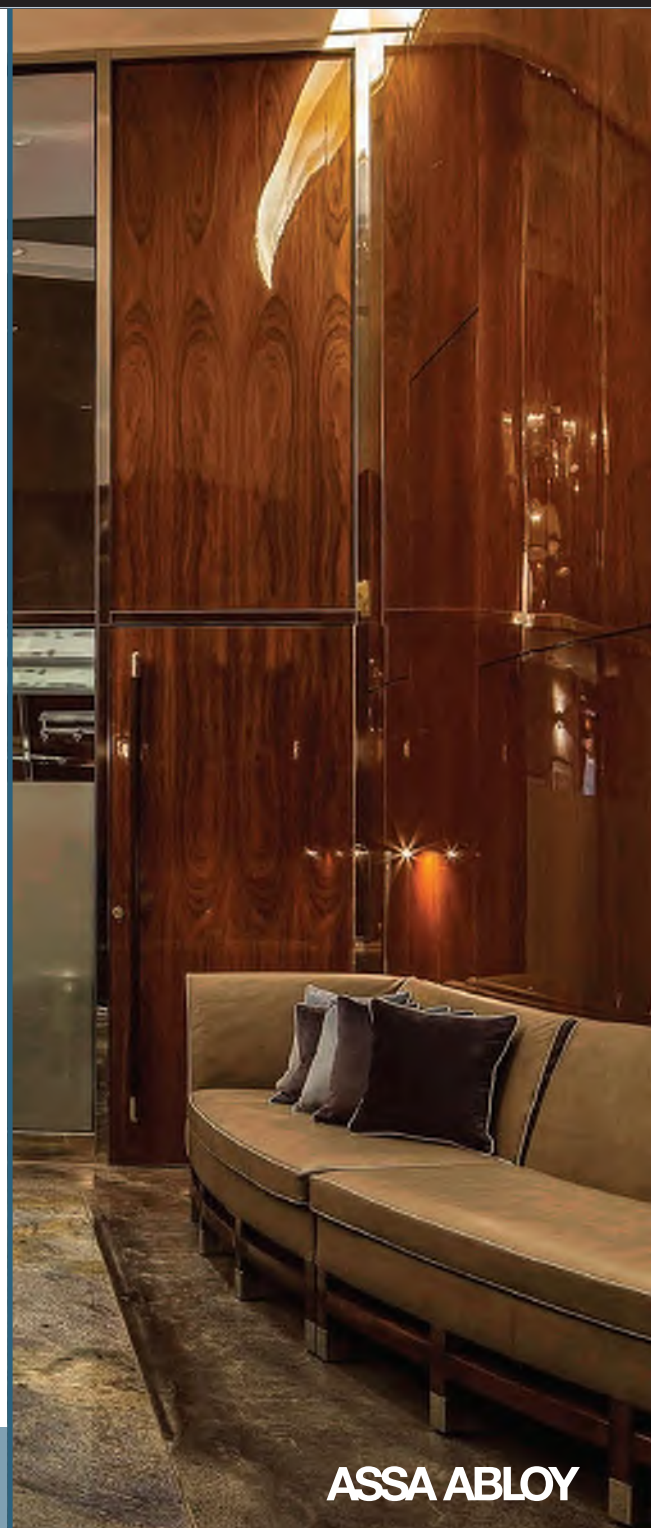


Features

- Key operated from outside; turn piece on inside
- Cylinder options: Yale® 1109 rim cylinder, Yale K680 SFIC housing, privacy, dummy or less cylinder
- Door types: $\frac{3}{8}$ " - $\frac{7}{8}$ " thick glass, $1\frac{3}{8}$ " - $2\frac{1}{2}$ " thick aluminum, hollow metal or wood doors
- Multiple locking options: floor, head or both
- Bolt location: 2" from face of door to centerline of bolt
- Bolt has $\frac{13}{16}$ " travel with fine adjustment
- Horizontal push/pull bar option

Benefits

- Cylinder and thumbturn location eliminates physical strain when locking and unlocking
- Glass door applications secure the opening without bulky patch fittings or rails
- Bolt concealed inside pull provides a clean, streamlined look
- Simple door preparation allows for faster installation
- Suites with popular ROCKWOOD door pulls, CORBIN RUSSWIN and SARGENT lever handles, McKINNEY hinges, creating a continuum of design
- Offers flexibility in custom sizes for a variety of applications



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AESTHETIC OPTIONS



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PostMount

LP3301 Series

PostMount - This basic post mounted pull is a clean and simple design. The simplicity adds contemporary beauty to standard entrance doors.



LP3401 Series

GripZone - This beautiful bright and brushed two-tone finish provides a "wear" area for gripping the pull. This minimizes the appearance of small scratches caused by rings and keys.



LP6061 Series

English Bridle Leather Wrapped - Authentic J & E Sedgwick & Co. Ltd. bridle leather imported from Walsall, England is hand sewn by a talented craftsman. Typically used for saddles and equestrian products, this smooth durable leather is suitable for both interior and exterior applications.



LP6161 Series

Upholstery Leather Wrapped - Supple yet durable leather makes a discriminating statement. Paired with the PostMount Locking Pull, this glove soft leather will add a level of sophistication to your interior.



GeoMetek

LP7901 Series

GeoMetek - This series offers a streamlined profile and crisp lines. The square pull complements the shape of the opening creating symmetrically balanced design.



LP6440 Series

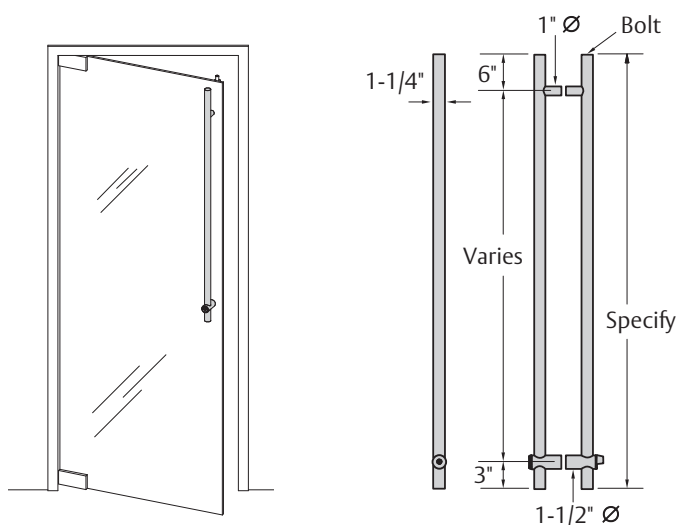
Upholstery Leather Wrapped - Beautifully crafted, the GeoMetek and Upholstery Leather combination produces an elegant composition. The leather is tightly wrapped and neatly sewn on the back and is offered in a plethora of custom colors.



MODEL OPTIONS

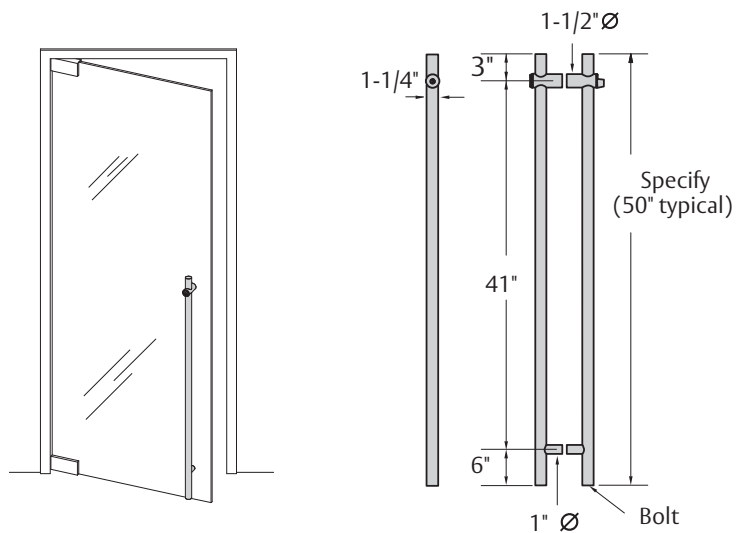
Half Height Pull - Bolts Up

DBU (Dead Bolt Up)



Half Height Pull - Bolts Down

DBD (Dead Bolt Down)



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ORDERING INFORMATION

PostMount Finishes:

Polished Brass	605	(US3)
Satin Brass	606	(US4)
Satin Oxidized Clear Coated	614	(US10BL)
Dark Satin Bronze Equivalent	613E	(US10BE)
Polished Stainless Steel	629	(US32)
Satin Stainless Steel	630	(US32D)
Satin Stainless Steel with MicroShield®	-	(US32DMS)
Polished Stainless Steel with MicroShield®	-	(US32MS)

GeoMetek Finishes:

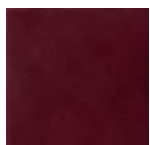
Dark Satin Bronze Equivalent	613E	(US10BE)
Polished Stainless Steel	629	(US32)
Satin Stainless Steel	630	(US32D)
Satin Stainless Steel with MicroShield®	-	(US32DMS)
Polished Stainless Steel with MicroShield®	-	(US32MS)

Leather Finish Standard Color Selections:

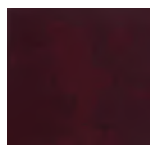
English Bridle Leather



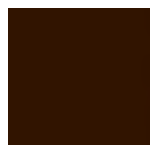
B-LBRN
(Light Brown)



B-BUR
(Burgundy)



B-MBRN
(Medium Brown)



B-DBRN
(Dark Brown)

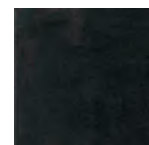


B-BLK
(Black)

Upholstery Leather



U-DBRN
(Dark Brown)



U-BLK
(Black)

Custom colors available

Accessories

(Ordered separately)

- LPS01 Top Strike
- LPS02 Top Strike
- LPS03 Top Strike
- LPS04 Transom Strike
- LPS05 Transom Strike
- 570 Dustproof Bottom Strike
- RM850 Door Stop
- Custom Strikes for unique conditions
- ADA Thumbturn



570 Dustproof
Bottom Strike



RM850 Door Stop

Thumbturns:



PostMount Thumbturn
(comes standard)



GeoMetek Thumbturn
(comes standard)



ADA Thumbturn
(PostMount only,
ordered as a suffix)

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Contact your local ASSA ABLOY Door Security Solutions team for more information on our Locking Door Pull systems or other Rockwood products.

Long door pulls are an artful and functional solution for any door. We offer both straight and offset versions. Most often used as full height, these pulls are available in three diameters and any length from 3 feet to over 8 feet long; see price list for more information. Specify a mid-post on full height pulls to provide the most rigid grip where heavy doors or high wind loads are present.

MegaTek™
long door pulls



Straight Pulls - Square Ends

Pull No.	Diameter	CTC
RM3300	1"	36" to 96"
RM3301	1½"	36" to 96"
RM3302	1¾"	36" to 96"



Straight Pulls - Round Ends

Pull No.	Diameter	CTC
RM3320	1"	36" to 96"
RM3321	1½"	36" to 96"
RM3322	1¾"	36" to 96"



Straight Pulls - Bent Ends

Pull No.	Diameter	CTC
RM3340	1"	36" to 96"
RM3341	1½"	36" to 96"
RM3342	1¾"	36" to 96"



Offset Pulls - Square Ends

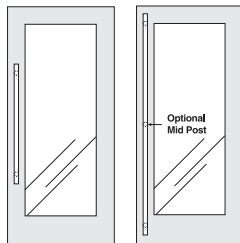
Pull No.	Diameter	CTC
RM3310	1"	36" to 96"
RM3311	1½"	36" to 96"
RM3312	1¾"	36" to 96"



Offset Pulls - Round Ends

Pull No.	Diameter	CTC
RM3330	1"	36" to 96"
RM3331	1½"	36" to 96"
RM3332	1¾"	36" to 96"

Application Suggestions



Base Metals: Aluminum (except offset models), brass, bronze, stainless steel

Options: • For optional mid-post, suffix the product number with "MP" (example: RM3301MP).
• Over 96" available on select finishes.



Carry Bar for No. 1600 /2600 Series Coordinator No. 1100

- Material:** Brass, steel
Finishes: US3, US4, US10, US10B, US26, US26D, and black prime coat
Fastener: 2 ea. 1/4-20x1 RH MS, 2 ea. 1/4-20x1 11/16 sex bolts
Other: A carry bar is used when it is possible to open the inactive door before opening the active door

No.	Size	Weight
1100	1 3/4" x 2 1/4"	0.3 lbs.

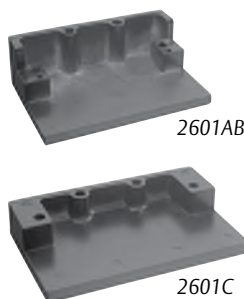


Filler Bar for No. 1600 /2600 Series Coordinator No. FB-1, FB-2

- Material:** Steel
Finishes: Black prime coat, silver powder coat
Features: Filler bar is supplied at no charge with the No. 1600 and 2600 Series coordinator (shown on pages E12 & E13)

No.	Size
FB-1	Specify length from 1 5/8" to 18 5/8"
FB-2	Specify length from 19 5/8" to 42 5/8"

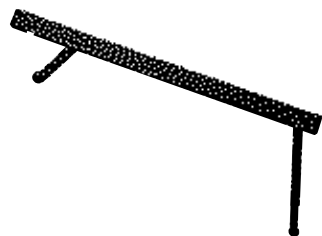
Contact factory for larger sizes.



Mounting Brackets (for Soffit Applied Hardware) No. 2601AB, 2601C

- Material:** Aluminum
Finishes: Black prime coat, silver powder coat
Fastener: 4 ea. 1/4-20x1/2" FH MS, 4 ea. #12-24x2" FH MS.
Features: Used for stop applied hardware. Prevents the inadvertent disabling of the coordinator by fasteners passing through the housing

No.	Soffit Size	Length	Weight
2601AB	7/8" - 2 1/4"	5"	0.9 lbs.
2601C	Over 2 1/4"	5"	0.8 lbs.



Universal Door Coordinator No. 1700

- Material:** Steel
Finishes: Black prime coat, silver powder coat
Fastener: 4 ea. 10-24 x 2" flat head machine screws and #10 x 2" sheet metal screws
Features: For pairs of doors up to 8' wide. Non-handed. Stop mounted – no mounting brackets required for stop mounted hardware

No.	Overall Size	Weight	ANSI A156.3
1700	1 1/2" x 25 9/16" x 3 1/4"	2.65 lbs.	Type 21B

NOTE: Not for use with surface vertical panic devices.

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Concealed Mount – Interior or Exterior – Medium Traffic Doors

Product Description & Features

- Doors may be single or double acting
- Non-handed
- Recommended for medium traffic, medium weight interior or exterior doors
- Low profile concealed channel designed for installation in aluminum storefront doors
- Heavy shock absorber spring provides 5-7° compression before dead stop
- Complete screw kit allows for installation in wood or metal door and frame
- For security areas, Torx® screws optional
- Standard architectural finishes
- Durable slider cam
- 110° maximum opening
- 1-3/4" minimum door thickness
- Channel is 1-1/4" wide by 1/2" deep
- Stop function UL listed for fire door assemblies
- Hanging means other than standard butts or offset pivots require special templating and pricing. Consult factory

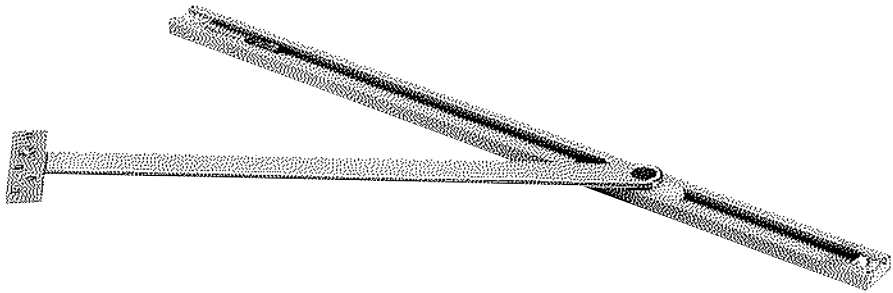
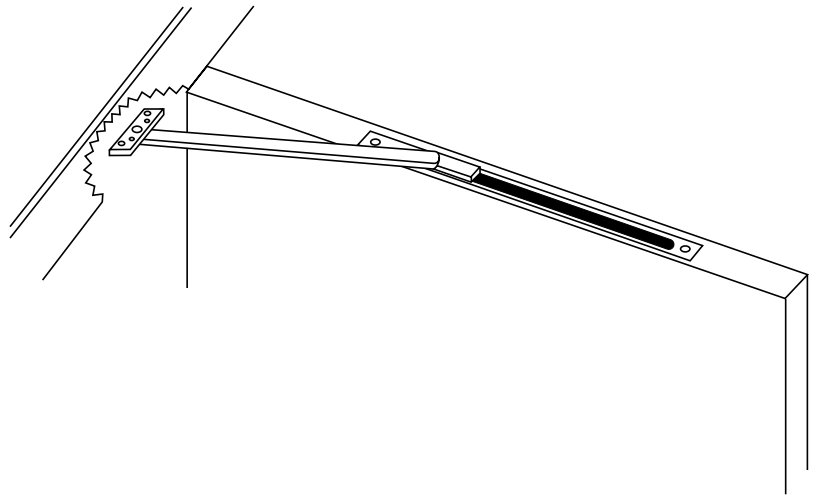


Chart (in inches)

Butts Offset Pivots	Center Hung Pivots	Model Number
Door Opening		Stop
*24 - 28	—	6-136
28-1/16 - 33	30 - 36	6-236
33-1/16 - 38	36-1/16 - 41	6-336
38-1/16 - 43	41-1/16 - 46	6-436
43-1/16 - 48	46-1/16 - 50	6-536

*Butt hung only on this size door. No swing clear hinges.

ANSI No.	
Shipping Weight 4.5 lbs.	Stop C01541

Options

Less Spring – Suffix LS

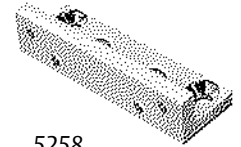
Heavy duty slide track type stops have a spring in the end of the channel that keeps the slider from deadstopping. If these units are being used with electromechanical closer, where the door must deadstop, the LS option is needed. For non-adjustable models 1 and 9 only.

Angle Jamb Bracket Adapter – Standard-duty models suffix 5258 (non-handed) Heavy-duty models suffix 5458 (LH) or 5459 (RH)

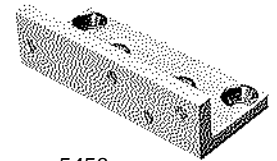
When surface mounted units are mounted on a rabbeted door on the push side, flush door and transom on the push side, or in a reverse installation on the pull side of the door a special bracket is needed. Note that not all models can be mounted on the pull side of the door (See specific model numbers in catalog.)

Security Screws – Suffix Torx

Security screws can be supplied for exposed fasteners.



5258



5458

Certifications

All Rixson Checkmate® overhead stops and holders are in compliance with ANSI/BHMA 156.8, Grade 1 and 2 Standards. See individual products for sub sections. See individual models for UL Listing.



Limited Warranty

Rixson Checkmate® stops and holders are warranted for 2 years for defect. See Rixson price book for specific details of the limited warranty

Specifications

All overhead stops and holders shall be from a single manufacturer.

Standard-duty models used for interior or low to medium traffic doors.

Heavy-duty models used for exterior or high traffic doors or doors subject to abuse.

For extremely abusive areas or high winds use double lever arm type.

Coordinate deadstop and/or hold open location with concealed floor closers.

Checkmate products provide hold open and/or deadstop.



Standard Duty Concealed OH200 Series

Material: Stainless steel

Finishes: US32D

Fasteners: Jamb: #12-24 x 1/2" FH MS or #12 x 1 1/2" FH WS
Door: #12-24 x 1 1/2" FH MS or #12 x 1 1/2" FH WS

- Features:**
- Doors may be single or double acting
 - Non-handed
 - Slide track design
 - Recommended for medium traffic, medium weight doors
 - Degree of opening is fully adjustable and can be adapted to changing needs
 - Heavy shock absorber spring provides 5-7° compression before deadstop
 - Multi-function unit is shipped as a stop. Can be converted to a hold open or friction in the field. MF5012 KIT (Adapter kit) included
 - Complete screw packet kit for installation in wood or metal door and frame
 - For security areas, Torx® screws available for exposed fasteners, but heavy-duty units should be considered for high security applications
 - Durable slider cam and shock block
 - 110° maximum opening
 - 3/4" square channel
 - Stop function UL listed for fire door assemblies

Door Opening

No.	Function	Butts/Offset Pivots	Center Hung	Weight	ANSI A156.8
OH201S	Stop only	18" - 24"	–	3.5 lbs.	C04542
OH202S	Stop only	24 1/16" - 30"	27" - 32"	3.5 lbs.	C04542
OH203S	Stop only	30 1/16" - 36"	32 1/16" - 38 1/2"	3.5 lbs.	C04542
OH204S	Stop only	36 1/16" - 42"	38 9/16" - 45"	3.5 lbs.	C04542
OH205S	Stop only	42 1/16" - 48"	45 1/16" - 48"	3.5 lbs.	C04542
OH201M	Multi-function	18" - 24"	–	3.5 lbs.	–
OH202M	Multi-function	24 1/16" - 30"	27" - 32"	3.5 lbs.	–
OH203M	Multi-function	30 1/16" - 36"	32 1/16" - 38 1/2"	3.5 lbs.	–
OH204M	Multi-function	36 1/16" - 42"	38 9/16" - 45"	3.5 lbs.	–
OH205M	Multi-function	42 1/16" - 48"	45 1/16" - 48"	3.5 lbs.	–

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8000 SERIES

Architectural Door Closer

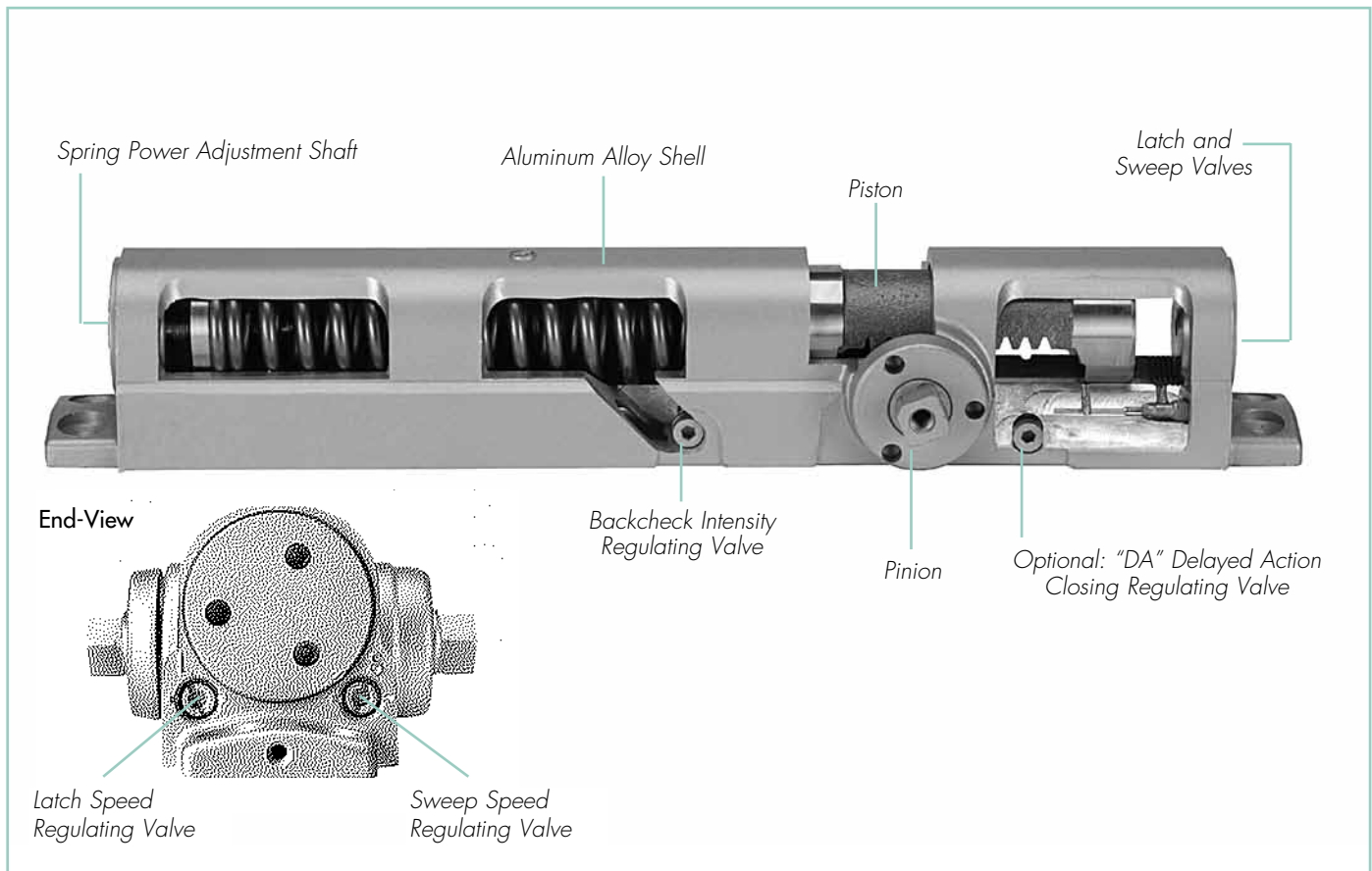


Norton[®]
ASSA ABLOY




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OVERVIEW

Cutaway View



COMPLIANCE STANDARDS

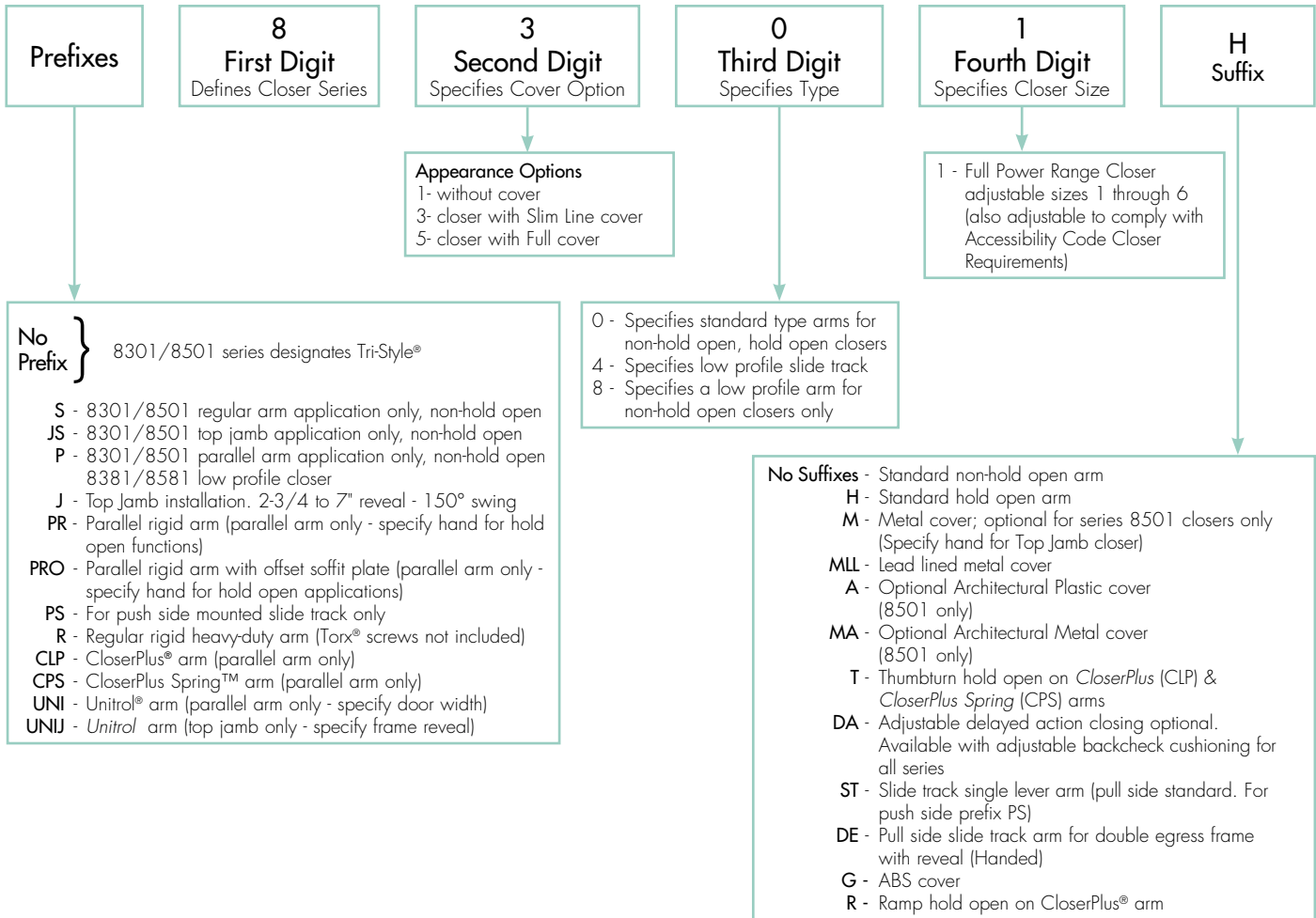
- ANSI/BHMA A156.4, Grade 1 certified 
- UL / cUL listed for use on fire rated doors 
- UL10C listed for positive pressure fire test
- 8301 and 8501 door closers are designed to comply with requirements for the Americans with Disabilities Act (A.D.A) and ANSI standard A117.1 
- This product is manufactured in an ISO 9001 facility

CAUTION: Door Closers for Low Opening Force Applications:

Door closers installed in openings required to meet the requirements of The Americans with Disabilities Act or ANSI/BHMA Standard A117.1, when adjusted to meet those requirements, may not provide adequate closing power to dependably close and latch the door.

HOW TO ORDER

For optimum protection of door and frame assemblies, always use auxiliary wall, floor, or overhead door stop.



Notes:

- Warranty becomes void if door closer is installed on the exterior side of a door in the exterior wall of a building.
- It is strongly recommended, and required on fire door assemblies, that doors having a door closer be hung on ball bearing or anti-friction hinges or pivots; unless an alternate method is identified in the door manufacturer's listing.
- Failure to use the correct type and size fasteners may void factory warranty.
- Fasteners for fire/smoke door assemblies must conform to NFPA 80. In some applications additional fasteners may be mandated by NFPA 80 that are not shipped with standard Norton product, such as sleeve-nuts/sex nuts or through-bolts and grommet nuts.
- Sizing charts provided on pages 13-25 are based on 1-3/4" (44mm) x 7" (2.13m) standard weight doors swinging to 110°. Other conditions (such as door height or weight; or wind/draft conditions) may require a larger size closer.

FASTENERS

Type	Description	Arm								
		RA	PA	TJ	Low Profile	PR	CLP / CPS	UNI	UNI-J	Slide Track
DOOR										
SDST	Self Drilling Self Tapping	S	S	S	S	S	S	S	O	O
MS	Machine Screw	S	S	S	S	S	S	S	S	S
SN	Sleeve Nut/Sex Nut	O	O	O	O	S	S	S	S	S
TBGN	Through-Bolts & Grommet Nuts	O	O	O	O	O	O	O	O	O
SMS	Sheet Metal Screws	O	O	O	O	O	O	O	O	O
Torx®	Torx Drive Security Screw	O	O	O	O	O	O	O	O	O
FRAME										
SDST	Self Drilling Self Tapping	S	S	S	S	S	S	S	S	S
MS	Machine Screw	S	S	S	S	S	S	S	S	S
SMS	Sheet Metal Screws	O	O	O	O	O	O	O	O	O
Torx	Torx Drive Security Screw	O	O	O	O	O	O	O	O	O

S = standard; O = optional

SN are for use on unreinforced hollow metal doors or to prevent any hollow metal door from collapse/dimpling. They can also be used for thru bolting on wood doors. SN are supplied for 1-3/4" (44mm) thick doors unless specified for 2-1/4" (57mm) thick doors.

TBGN are an alternative to SN for wood doors. TBGN are supplied standard for 1-3/4" (44mm) thick doors. They can be specified for 1-3/8" (35mm) thick doors.

SMS - when specified, closer will be packed with sheet metal screws for the door AND sheet metal screws plus machine screws for the frame.

TORX screws with security pin are standard with Security Door Closers. Torx may be specified for all other series applications. Torx are only available with machine screw threads. Sheet metal screw threads or wood screw threads are not available.

Note: To order special fasteners with closers, specify model number x fastener (Ex: 8501 x 689 x TBGN)

FINISHES

Norton offers waterborne acrylic, polyester powder coat and plated finishes. Custom finishes are available on special order. A sample and approval is required.

Waterborne acrylic and polyester powder coat will withstand 100 hours of salt spray (ANSI requires 25 hours).

ANSI/BHMA	Description
600*	Prime Coat
605	Bright Brass
606	Satin Brass
611	Bright Bronze
612	Satin Bronze
613E	Dark Oxidized Satin Bronze - Equivalent
619	Satin Nickel
625	Bright Chrome
626	Satin Chrome

ANSI/BHMA	Description
689	Aluminum
690	Statuary Bronze
691	Dull Bronze
693	Black
694	Medium Amber
696	Gold
N/A	556 White

* 600 is a special rust-inhibiting prime coat. Closers can be ordered prime coat only (specify closer x 600). An additional charge applies if finish coat is required over prime coat.

- Norton closer bodies and plastic covers are available in waterborne acrylic finishes. Arms and metal covers are available in powder coat or plated finishes.
- When a plated finish is ordered, arm and cover will be plated unless "cover only" is specified.

FEATURES

Aluminum Alloy Housing

Closer bodies are constructed of a special aluminum alloy, carefully selected to accommodate interactive steel components and operating conditions.

Rack & Pinion Operation

Provides a smooth constant control of the door through its full opening and closing cycle. 180° door swing can be achieved when door, frame, hardware and arm function do not interfere.

Non-handed

With few exceptions all series 8301/8501 door closers are non-handed and can be installed on either right- or left-hand swing doors. Pinion shaft extends vertically through the closer body in both directions. Some options, as noted on pages 6-7, will require that the hand of the closer be specified.

Sweep Speed Control Valve

Allows adjustment of door speed from the door's full open position down to approximately 10° from the closed position.

Latch Speed Control Valve

Allows adjustment of door speed from approximately 10° down to the door's fully closed position.

Tri-Style®

8301/8501 comes with screws, brackets and soffit plates to allow for regular, top jamb, and parallel arm installations.

Adjustable Backcheck Valve

Provides control of the door in the opening cycle, beginning at approximately 75° of door opening. It cushions the door opening when the door is forcibly opened beyond its pre-adjusted limits.

Standard Molded Covers

Molded of high-impact U.L. listed material. These covers are non-handed for all applications.

Warranty

Limited 25-year warranty for defects and life of the building on the aluminum housing.

Closer Fluid

NorGlide® closer fluid is a specially formulated multi-viscosity hydraulic fluid that contains lubricity and anti-oxidation agents that provide optimum performance and efficiency. This fluid complements the interaction of the door closer's aluminum housing with its steel and brass components, while maintaining stable viscosity to allow the door closer to perform in temperatures ranging from extremely high to as low as -40° F.

Door Closer Power Options

Series 8301/8501 Multi-Sized Door Closer

Adjustable through the power range of sizes 1 through 6; as outlined in ANSI/BHMA specification A156.4 option PT 4H.

Closers will also comply with the opening force requirements as outlined in the Americans with Disabilities Act (ADA) and ANSI/BHMA standard A117.1 for interior doors.

OPTIONAL FEATURES COVERS

Optional Metal Cover

This steel cover is non-handed for regular and parallel arm applications, but is handed for top jamb applications. Cover is available in sprayed or plated finishes.



Optional Architectural Covers *

Plastic Architectural plastic covers are molded of high-impact U.L. listed material. They are non-handed and available in sprayed finishes.

Metal The architectural metal covers are steel and non-handed for all applications. These covers are available in sprayed or plated finishes.



Optional ABS Cover

Consult factory for details

OPTIONAL FEATURES

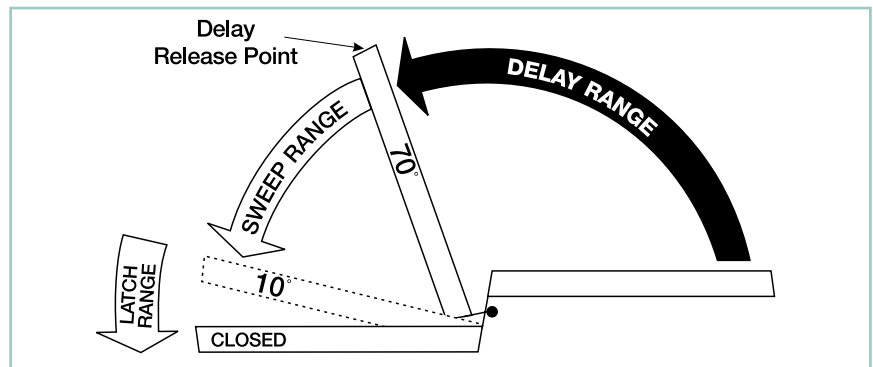
Adjustable Delayed Action Closing

An optional hydraulic feature that adds a third speed range to the closing cycle. This feature becomes effective when the door is opened and released at any point beyond 70°. The amount of time delay depends upon the combination of the angle of door release and valve adjustment. The valve can be adjusted with a 1/8" (3mm) hex key from no delay time up to maximum delay times of:

Door Opened	Approximate Time of Delay Cycle
180°	4-5 minutes
120°	2-3 minutes
90°	25-30 seconds

Pressure Relief Safety Valve

The delayed action hydraulic system contains a pressure relief valve. Any time the door is forced toward the closed direction while it is in the closing cycle, the valve will open and permit the door to close. This prevents damage to door, frame and closer.



Suggested Applications

Delayed action closing allows slow-moving traffic to clear the opening before the door closer's normal closing cycle begins. This feature can be helpful in health care facilities such as hospitals and nursing homes. It provides sufficient time for persons on crutches or in wheelchairs to pass through a door without concern of it closing. At the same time, it can accommodate the facility's staff with movement of food service carts, beds, and other wheeled traffic.

Use of delayed action closers on many doors throughout industrial and commercial buildings can also assist the flow of traffic. Locations where additional time to clear the opening is advantageous are doors between office and factory/warehouse facilities, doors to workshops or laboratories, to kitchen and food processing areas, etc.

OPTIONAL FEATURES ARMS

Non-Hold Open

Self-closes door every time door is opened. Auxiliary stop (by others) required except when using the CloserPlus®, CloserPlus Spring™ or Unitrol® arms.

Hold Open

Achieved by means of friction or ball and detent/ roller. Friction hold open has a range of 90° to 180° using template location and mechanical adjustment.

Ball and detent or roller hold open is effective in a range of 85° to 110°.

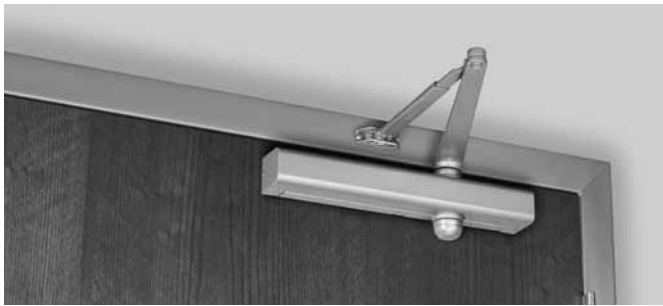
Hold open arm door closers are not permitted to be used on fire door assemblies.

Door Opening Degrees

Arm Function	Regular Arm, Top Jamb Parallel Arm	Parallel Rigid Arm	CloserPlus® Parallel Arm	CloserPlus Spring™ Parallel Arm	Unitrol® Parallel Arm	Unitrol Top Jamb	Low Profile Regular, Parallel	Slide Track
Non-Hold Open	✓	✓	85° to 110°	85° to 110°	85° to 110°	85° to 110°	✓	85° to 110°/180°
Hold Open	90° to 180°	85° to 180°	85° to 110°	85° to 110°	85° to 110°	85° to 110°	N/A	85° to 110°

✓=180° trim and template permitting

APPLICATIONS



Regular Arm

8301 - slim cover

This is the only pull-side application where a double lever arm is used. It is the most power-efficient application for a door closer. Sufficient frame, door and/or ceiling clearance must be considered.



8501 - full cover

Since the arm assembly projects directly out from the frame, this application may present an aesthetics issue or be prone to vandalism.



Top Jamb

For efficiency reasons this application provides the best alternative to the regular arm application. There must be sufficient frame face and/or ceiling clearance for this application. It requires a top rail on the door of just 2-1/4" (57mm). This application provides the best door control for doors in exterior walls that swing out of a building.



Parallel Arm

This application provides the most appealing design appearance for a surface-mounted door closer having a double lever arm. This also makes it beneficial in vandalism-prone areas. It is on the push side of the door and the arm assembly extends almost parallel to the door. In the closed position, there is very little or no hardware projecting beyond the frame face in most situations.



Due to the geometry of the arm it is approximately 25% less power efficient than a regular arm application. The entire closer and arm assembly are mounted below the frame stop. Top rail clearance dimensions will vary based on the type of cover used. (See pg. 15)

APPLICATIONS



Non-hold open arm shown



Non-hold open arm shown

Parallel Rigid Arm

An enhanced variation of the standard parallel arm assembly that is intended for use in heavy traffic areas where auxiliary door stops are installed.

Hold open available - specify hand when ordering.

CloserPlus® Arm

Similar to the Parallel Rigid arm, this arm incorporates a stop at the arm's soffit plate to dead stop the door at a predetermined degree of door swing between 85° and 110°, in 5° increments. Prior to dead stop the door closer's backcheck feature slows the door speed to reduce the impact of the stop action.

The *CloserPlus* Arm is intended for use where an auxiliary door stop cannot be utilized and no more than moderate abuse is anticipated. Where more extreme conditions are expected, use of a *Unitrol* arm is recommended.

Available with or without hold open. (Hold open strength is adjustable.)



Non-hold open arm shown



CloserPlus Spring™ Arm

This arm has all the characteristics of the *CloserPlus* arm with an additional steel buffer spring that provides greater protection at the end of the door opening cycle.

For extreme conditions, use of a *Unitrol* arm is recommended. Available with or without hold open.

CloserPlus Ramp™

The CLPR uses a patent pending ramp and plunger design that easily slides into place reducing wear often seen on traditional hold open arms. Ideal for applications where the door will constantly be pulled out of hold open.

APPLICATIONS



Regular Rigid Arm

This double lever arm features a non-adjustable secondary arm. Orbitally riveted joints prevent tampering or disassembly. Prefix "R" to model number. Available non-hold open only.



Parallel Rigid Offset Arm

This heavy-duty parallel rigid arm provides additional vertical clearance. It is well suited for applications where weatherstripping or other hardware prevents the use of the standard Parallel Rigid (PR) soffit plate. The non-hold open and hold arms allow 1-1/4" clearance. When used in conjunction with a #6891 spacer block, the PRO arm provides 1-7/8" clearance to accommodate the use of a surface overhead stop/holder.



Parallel

Unitrol® Arm

Can be used for either parallel arm or top jamb applications. *Unitrol* arms combine the features of a double lever arm overhead door stop/holder with the backcheck feature of the door closer to reduce door stopping shock loads to a minimum. The *Unitrol* uses a compression spring buffer at the soffit plate/arm shoe that will absorb 30 lbf. of force, 5° prior to the door's dead stop. Coupled



Top Jamb

with the door closer's backcheck feature, this arm provides the most controlled stop available with a surface door closer. For parallel arm applications there are three different length arm assemblies. Each length is designed for a specific range of door widths, to provide precise door control. This further lessens the dead stop impact on the door's hinges/pivots.

APPLICATIONS



Pull Side



Low Profile Pull Side



Push Side



Low Profile Push Side

Slide Track

Whether pull- or push-side mounted, slide track provides the designer with the smoothest lines available in a surface-mounted door closer. The single lever arm allows components to be located in a stack configuration to minimize projection and eliminate obtrusive arm angles. The arm geometry reduces door closer power efficiency by approximately 25% from that of a regular arm.

Standard unit:

- Adjustable 85°- 110° (hold open and non-hold open). Track is supplied with a spring buffered stop. An auxiliary stop, by others, is recommended.
- Specify if hold open unit is required.
- 180° swing (non-hold open, pull side only) is also available. This track assembly requires that a door stop, by others, be supplied to stop the door.



Regular Arm



Parallel Arm

Regular Arm: Allows closer to be installed where there is as little as 1" (25mm) of frame face or ceiling clearance.

Parallel Arm: Allows closer to be installed 1/2" (13mm) higher up on door than standard parallel arm application.

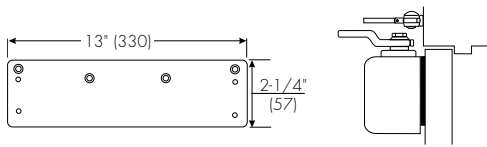
Low Profile Arm

Supplied with 8381/8581 series door closers for non-hold open installations only. Low profile arms have a reduced height elbow joint and a straight main arm. This enables the door closer to be installed in less vertical space.

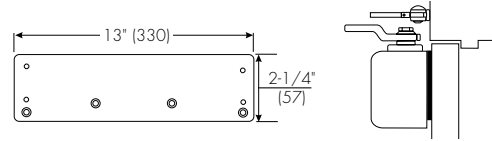
Note: Low profile arm door closers are not supplied with Tri-Style® packaging.

REGULAR ARM

Closer Mounting Plates
Slim Line Installations

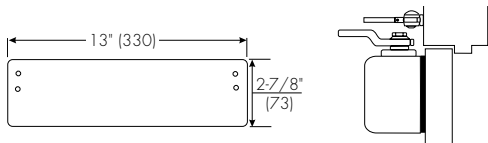


Narrow Top Rail - #8146 Drop Plate: For use where the narrow top rail of the door prevents the closer from being mounted directly on to the door surface. This drop plate must be used for any Series 8000 closer mounted on a top rail between 1-9/16" and 2-7/16" (40 and 62mm) in height, or any Series 8080 closer mounted on a top rail between 1-7/16" and 2-5/16" (36 and 59mm) in height.

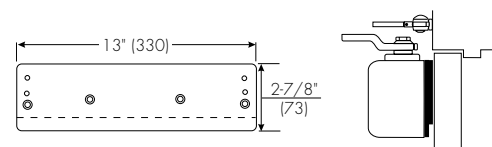


Concealed Door Holder - #8146 Drop Plate: For use where a concealed door holder prevents normal mounting of the closer to the door. This is the same plate used for narrow rail mounting, but is inverted for this application to permit the mounting screws to clear the bottom of the door-holder preparation in the top rail of the door. This places the centerline of the plate's upper mounting screws at 2-3/16" (56mm) from the top of the door.

Full Cover Installations

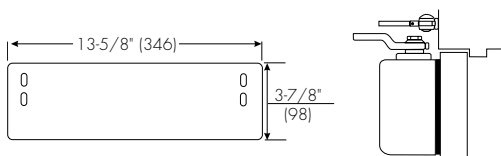


Exposed Back - #8445 Molded Full Cover Decorative Back Plate: For use on doors with glass lights where a closer with a molded full cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

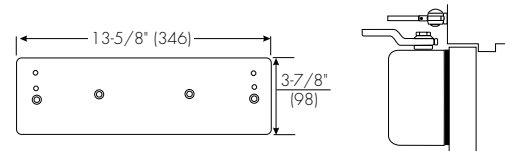


Exposed Back/Narrow Top Rail - Exposed Back Concealed Door Holder - #8446 Molded Full Cover Drop Plate Kit: For use with molded full cover installation when an 8146 Plate is needed as a drop plate on a narrow top rail, or as a clearance plate for a concealed door holder, and the closer back is exposed. Kit contains an 8146 Drop Plate and an 8445 Decorative Plate.

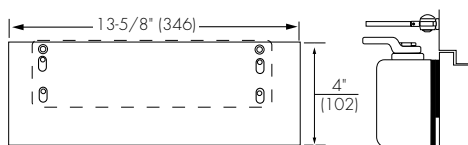
Metal Cover Installations



Exposed Back - #8545 Metal Cover Decorative Back Plate: For use on doors with glass lights where a closer with a metal full cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.



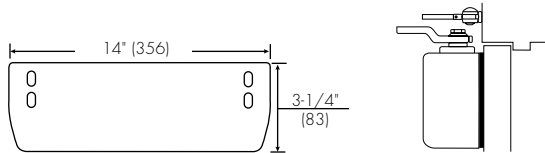
Concealed Door Holder - #8546 Metal Cover Drop Plate: For use where a concealed door holder prevents the normal mounting of the closer to the door. This plate permits the mounting screws to clear the bottom of the door-holder preparation in the top rail of the door. This places the centerline of the plate's upper mounting screws at 2-3/16" (56mm) from the top of the door.



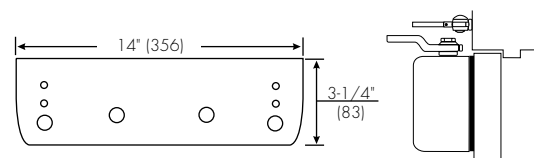
Exposed Back/Narrow Top Rail - #8549 Metal Cover Drop Plate Kit: For use with metal full cover installations, when an 8146 Plate is needed as a drop plate on a narrow top rail and the closer back is exposed. Kit contains an 8146 Drop Plate and an 8545 Decorative Plate.

REGULAR ARM

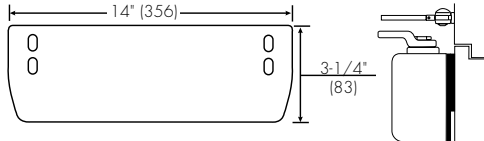
Closer Mounting Plates
 Architectural Plastic or Metal Cover Installations



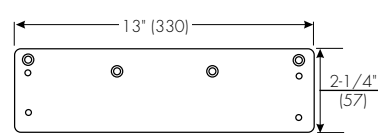
Exposed Back - #8545A Architectural Plastic or Architectural Metal Cover Decorative Back Plate: For use on doors with glass lights where a closer with an architectural plastic or metal cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.



Concealed Door Holder - #8546A Architectural Plastic or Architectural Metal Cover Drop Plate: For use where a concealed door holder prevents the normal mounting of the closer to the door. This plate permits the mounting screws to clear the bottom of door-holder preparation in the top rail of the door. This places the centerline of the plate's upper mounting screws at 2-3/16" (56mm) from the top of the door.

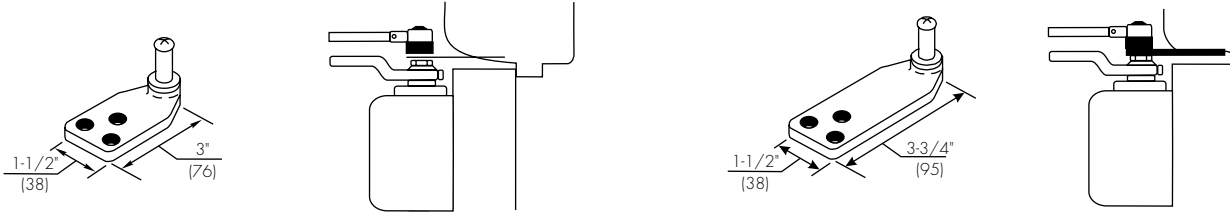


Exposed Back/Narrow Top Rail - #8549A Architectural Plastic or Architectural Metal Cover Drop Plate Kit: For use with architectural plastic or metal cover installations when an 8146 plate is needed as a drop plate on a narrow top rail and the closer back is exposed. Kit contains an 8146 Drop Plate and an 8545A Decorative Plate.



REGULAR ARM

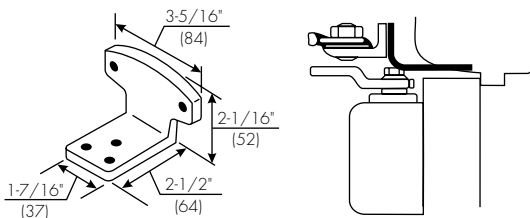
Brackets for Non-Hold Open Arms



Molded/Bull Nose Trim - #2403B Bracket: For use where the door frame has molded or bull nose trim which will not accept a standard non-hold open shoe. The bracket is mortised into the frame rabbet, and projects beyond the face of the frame. It will accommodate a frame rabbet up to 2" (51mm) deep.

Molded / Bull Nose Trim - #2403-3/4 Bracket: This bracket is similar to, but longer than, the 2403B bracket. It is designed to accommodate frame rabbets from 2" to 2-7/8" (51 to 73mm) deep.

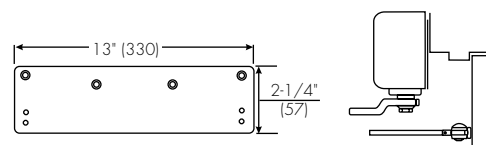
Brackets for Hold Open Arms



Molded / Bull Nose Trim - #80 Bracket: For use where the door frame has molded or bull nose trim which will not accept a standard hold open shoe. It is mortised into the frame rabbet, and projects beyond the face of the frame. It will accommodate a rabbet up to 2" (51mm) deep. This bracket is used in combination with the standard hold-open mounting shoe.

TOP JAMB ARM

Closer Mounting Plates
Slim Line Installations

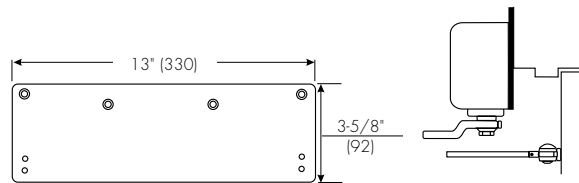


Low Ceiling Clearance - #8146 Drop Plate: For use where low ceiling clearance prevents normal top jamb mounting. This plate is used when clearance is from 1-7/8" to 2-7/8" (48 to 73mm). Where ceiling clearance is less than 1-7/8" (48mm) see #8148 Drop Plate on page 30.

Overhead Door Holder - #8146 Drop Plate: For use where a surface or concealed overhead door holder prevents normal top jamb mounting. This plate drops the closer and allows arm mounting screws to clear the bottom of the door holder. This places the centerline of the arm mounting screws at 2-7/8" (73mm) from the top of the door.

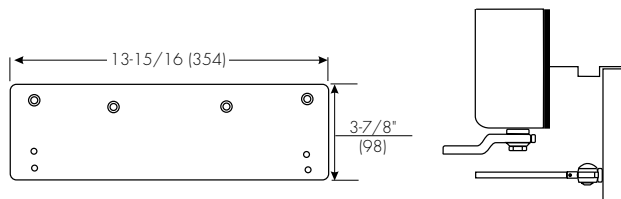
TOP JAMB ARM

Closer Mounting Plates
Slim Line Installations



Low Ceiling Clearance - #8148 Drop Plate: For use where the ceiling clearance is between 1-1/2" and 1-3/4" (38 and 44mm).

Metal Cover Installations

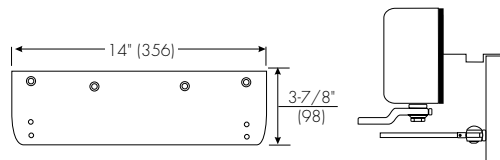


Low Ceiling Clearance -
Overhead Door Holder -

#8547 Metal Full Cover Drop Plate: For use where a low ceiling clearance prevents normal top jamb mounting. This plate is used when the clearance is between 1-5/8" and 3-7/8" (41 and 98mm). Or for use where a surface or concealed overhead door holder prevents normal top jamb mounting of a

closer with a metal full cover. This plate drops the closer and allows arm mounting screws to clear the bottom of the door holder. This places the centerline of the arm mounting screws at 3-7/8" (98mm) from the top of the door.

Architectural Plastic or Metal Cover Installations



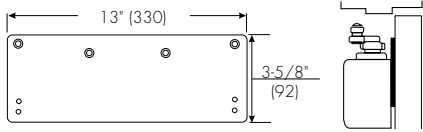
Low Ceiling Clearance -
Overhead Door Holder -

#8547A Architectural Plastic or Architectural Metal Cover Drop Plate: For use where low ceiling clearance prevents normal top jamb mounting. This plate is used when the clearance is between 1-5/8" and 3-7/8" (41 and 98mm). Also for use where a surface or concealed overhead door holder prevents normal top jamb mounting of a closer with an

architectural plastic or metal full cover. This plate drops the closer and allows arm mounting screws to clear the bottom of the door holder. This places the centerline of the arm mounting screws at 3-7/8" (98mm) from the top of the door.

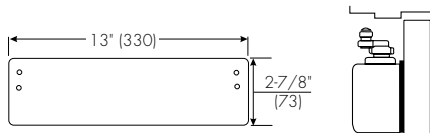
PARALLEL ARM

Closer Mounting Plates
Slim Line Installations

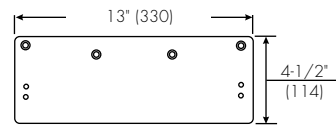


Narrow Top Rail - #8148 Drop Plate: For use where a narrow top rail prevents the closer from being mounted directly to the door surface. This drop plate can be used to mount a closer on a top rail as narrow as 2-7/8" (73mm) in height.

Full Cover Installations

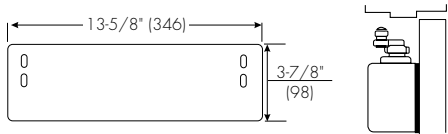


Exposed Back - #8445 Molded Full Cover Decorative Back Plate: For use on doors with glass lights where a closer with molded full cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

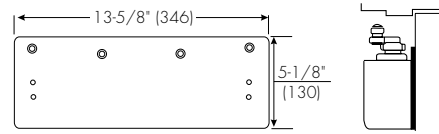


Exposed Back/Narrow Top Rail - #8158 Molded Full Cover Drop Plate: For use on doors with glass lights where a closer with molded full cover is installed and the back of the closer is exposed. This covers the back of the installation and gives a pleasing appearance from the reverse side.

Metal Cover Installations

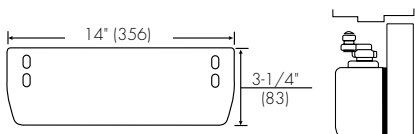


Exposed Back - #8545 Metal Full Cover Decorative Back Plate: For use on doors with glass lights where a closer with full metal cover is installed and the back of the closer is exposed. This plate covers the back of the installation and gives a pleasing appearance from the reverse side.

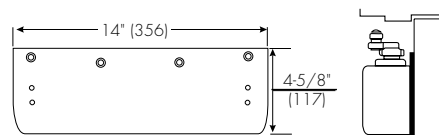


Exposed Back/Narrow Top Rail - #8548 Metal Full Cover Drop Plate: For use on doors with glass lights where a closer with metal full cover is installed on a narrow top rail, and the back of the cover is exposed. This drop plate can be used to mount a closer on a top rail as narrow as 2-7/8" (73mm) in height. This plate covers the back of the installation and gives a pleasing appearance from the reverse side.

Architectural Plastic or Metal Cover Installations



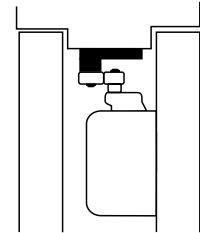
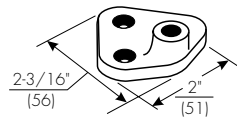
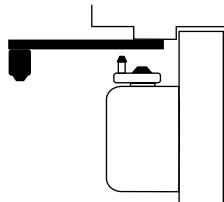
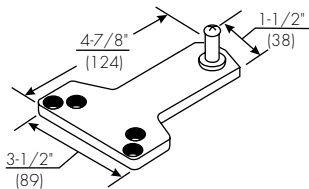
Exposed Back - #8545A Architectural Plastic or Architectural Metal Cover Decorative Back Plate: For use on doors with glass lights where a closer with an architectural plastic or metal cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.



Exposed Back/Narrow Top Rail - #8548A Architectural Plastic or Architectural Metal Cover Drop Plate: For use on doors with glass lights where a closer with an architectural plastic or metal cover is installed on a narrow top rail, and the back of the cover is exposed. This drop plate can be used to mount a closer on a top rail as narrow as 2-7/8" (73mm) in height. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

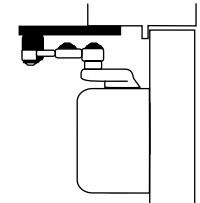
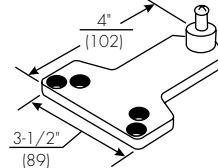
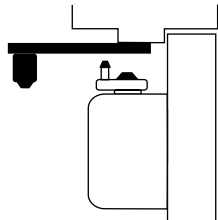
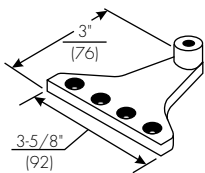
PARALLEL ARM

Brackets for Non-Hold Open Arms



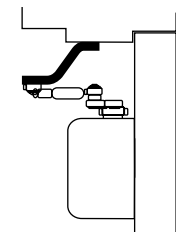
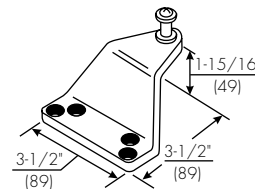
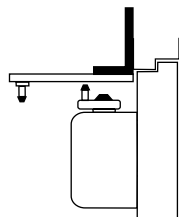
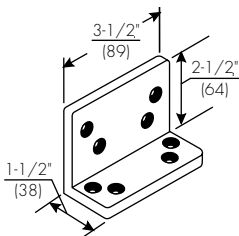
Standard Installation - #1618A Soffit Plate: This soffit plate is supplied standard with parallel arm closers. It can be mounted where the frame soffit is as narrow as 1" (25 mm).

Mounting between Doors - #2018 Soffit Bracket: For use where insufficient space between companion doors does not permit use of other soffit plates. This bracket permits mounting of the closer between doors with as little as 3" (76mm) of header space. Permits closer arm to clear up to 5/8" (16mm) high stop.



Narrow Frame/Removable Stop - #2018B Soffit Plate: For use where a narrow frame or frame with removable stop does not permit use of the standard soffit plate. This soffit plate may be mounted on the frame soffit or the frame rabbet where the stop does not exceed 5/8" (16mm) in height. All of the screw holes are in a straight line, requiring as little as 1-1/4" (32mm) of frame reveal to mount bracket and maintain good closer arm geometry. Where the frame soffit is as wide as 2" (51mm), this soffit plate may be used to clear weather-stripping that is up to 1-3/8" (35mm) wide and 5/8" (16mm) in height.

Blade/Applied Stop - #2018D Soffit Plate: For use where a blade or applied stop does not permit installation of the standard soffit plate. Mounts to either the frame soffit or rabbet. Since this soffit plate projects 7/8" (22mm) less than a standard soffit plate, it requires a minimum frame reveal of 1-1/2" (38mm). Permits closer to clear up to a 5/8" (16mm) stop.

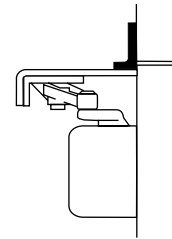
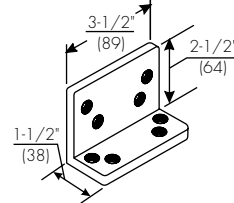
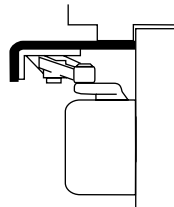
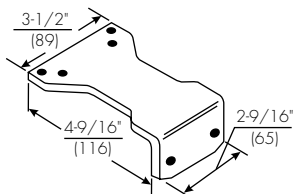


Flush Transom - #2022 Angle Bracket: For use where rabbeted or flush transom conditions prevent installation of a soffit plate. Used in combination with the 1618 soffit plate, or may be used in combination with the 2018S soffit plate when it is necessary for the closer arm to clear a separate overhead door holder.

Extra-Clearance - #2018S Offset Soffit Plate: For use where the need for additional clearance prevents use of the standard soffit plate. This plate mounts to the frame soffit to provide up to 2" (51mm) of clearance when a separate overhead door holder is used. Standard mounting requires a 2-5/8" (67mm) wide frame soffit. It may also be used where unusually high frame stops or weather-stripping prevent the use of other soffit plates.

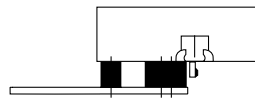
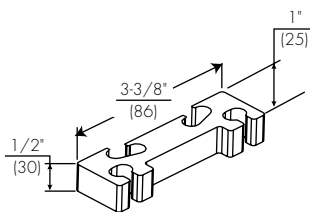
PARALLEL ARM

Brackets for Non-Hold Open & Hold Open Arms



Parallel Hold-Open - #1628H Adapter Plate: Supplied standard with all parallel arm hold open closers. It can also be used to convert regular arm or top jamb hold open arms to parallel arm installation. It can be mounted where the frame soffit is as narrow as 1" (25mm).

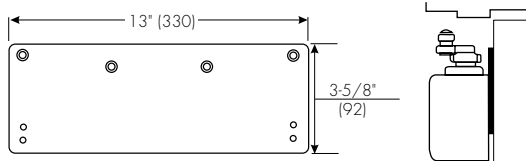
Flush Transom - #2022 Angle Bracket: For use where rabbeted or flush transom conditions prevent installation of a soffit plate. Used in combination with the 1628H adapter plate, this bracket fastens to the overhead transom to provide a mounting surface for the soffit plate assembly.



Clearance/Support Blade Stop - #6891 Spacer Block: For use where the door frame has a blade stop and the soffit plate must be mounted on the frame rabbet. This accessory is used in combination with the standard spacer block to provide clearance of the blade stop. Also used with non-hold open arms.

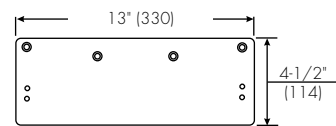
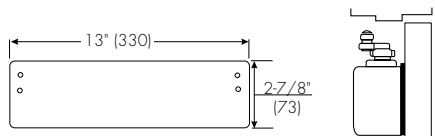
PR, CLP & CPS ARMS

Closer Mounting Plates
Slim Line Installations



Narrow Top Rail - #8148 Drop Plate: For use where a narrow top rail prevents the closer from being mounted directly to the door surface. This drop plate can be used to mount a closer on a top rail as narrow as 2-9/16" (65mm) in height.

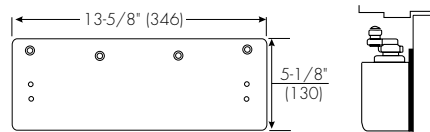
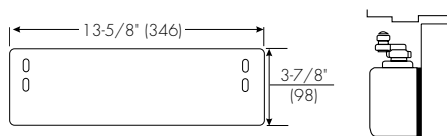
Full Cover Installations



Exposed Back - #8445 Molded Full Cover Decorative Back Plate: For use on doors with glass lights where a closer with molded full cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

Exposed Back/Narrow Top Rail - #8158 Molded Full Cover Drop Plate: For use on doors with glass lights where a closer with molded full cover is installed and the back of the closer is exposed. This covers the back of the installation and gives a pleasing appearance from the reverse side.

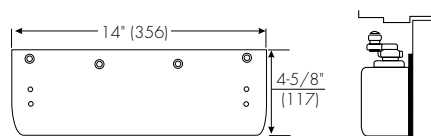
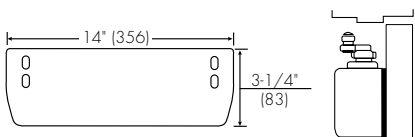
Metal Cover Installations



Exposed Back - #8545 Metal Full Cover Decorative Back Plate: For use on doors with glass lights where a closer with full metal cover is installed and the back of the closer is exposed. This plate covers the back of the installation and gives a pleasing appearance from the reverse side.

Exposed Back/Narrow Top Rail - #8548 Metal Full Cover Drop Plate: For use on doors with glass lights where a closer with metal full cover is installed on a narrow top rail, and the back of the cover is exposed. This drop plate can be used to mount a closer on a top rail as narrow as 2-9/16" (65mm) in height. This plate covers the back of the installation and gives a pleasing appearance from the reverse side.

Architectural Plastic or Metal Cover Installations

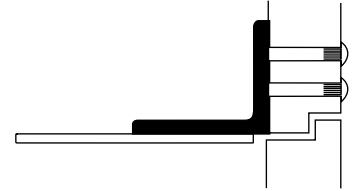
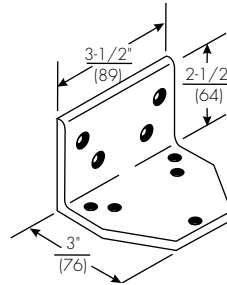
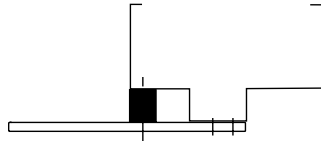
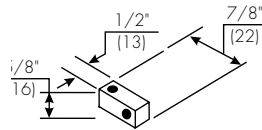


Exposed Back - #8545A Architectural Plastic or Architectural Metal Cover Decorative Back Plate: For use on doors with glass lights where a closer with an architectural plastic or metal cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

Exposed Back/Narrow Top Rail - #8548A Architectural Plastic or Architectural Plastic or Architectural Metal Cover Drop Plate: For use on doors with glass lights where a closer with an architectural plastic or metal cover is installed on a narrow top rail, and the back of the cover is exposed. This drop plate can be used to mount a closer on a top rail as narrow as 2-9/16" (65mm) in height. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

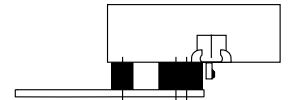
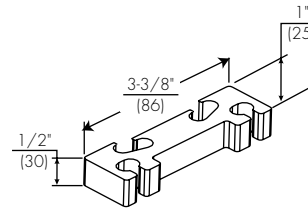
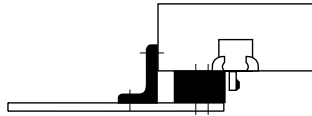
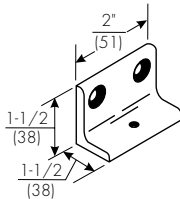
PR, CLP & CPS ARMS

Brackets for Non-Hold Open Arms & Hold Open Arms



Standard - #2019S Spacer Block: For use where a narrow frame soffit does not provide adequate support for the soffit plate. Supplied as standard with all parallel rigid arm closers.

Flush Rabbeted Transom - #2019L Angle Bracket: For use where flush rabbet conditions prevent mounting of the standard soffit plate. This bracket is used in combination with the standard soffit plate.

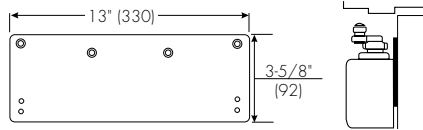


Narrow Frame - #6890 Support Bracket: For use where the frame is narrow and the soffit plate cannot be mounted directly to the frame soffit or rabbet. Used in combination with the #6891 Spacer Block on blade stop frames to provide extra support and needed clearance of the blade stop. Used on frames where the frame stop does not exceed 5/8" (16mm) in height.

Clearance/Support Blade Stop - #6891 Spacer Block: For use where the door frame has a blade stop and the soffit plate must be mounted on the frame rabbet. This accessory is used in combination with the standard spacer block to provide clearance of the blade stop.

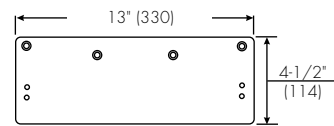
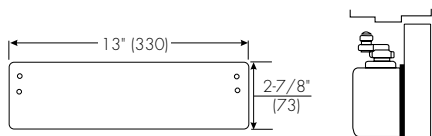
UNITROL® ARM

Closer Mounting Plates
Parallel Arm



Narrow Top Rail - #8148 Drop Plate: For use where a narrow top rail prevents the closer from being mounted directly to the door surface. This drop plate can be used to mount a closer on a top rail as narrow as 2-7/16" (62mm) in height.

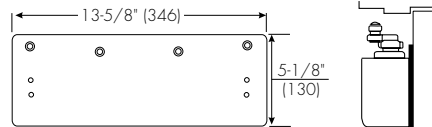
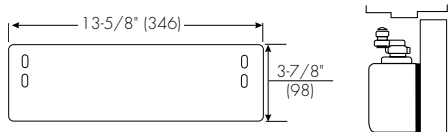
Full Cover Installations



Exposed Back - #8445 Molded Full Cover Decorative Back Plate: For use on doors with glass lights where a closer with molded full cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

Exposed Back/Narrow Top Rail - #8158 Molded Full Cover Drop Plate: For use on doors with glass lights where a closer with molded full cover is installed and the back of the closer is exposed. This covers the back of the installation and gives a pleasing appearance from the reverse side.

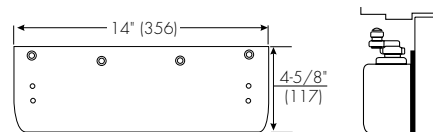
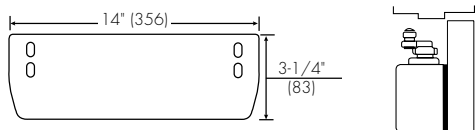
Metal Cover Installations



Exposed Back - #8545 Metal Full Cover Decorative Back Plate: For use on doors with glass lights where a closer with full metal cover is installed and the back of the closer is exposed. This plate covers the back of the installation and gives a pleasing appearance from the reverse side.

Exposed Back/Narrow Top Rail - #8548 Metal Full Cover Drop Plate: For use on doors with glass lights where a closer with metal full cover is installed on a narrow top rail, and the back of the cover is exposed. This drop plate can be used to mount a closer on a top rail as narrow as 2-9/16" (65mm) in height. This plate covers the back of the installation and gives a pleasing appearance from the reverse side.

Architectural Plastic or Metal Cover Installations



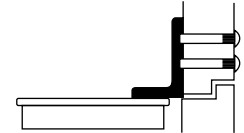
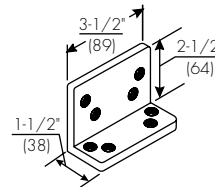
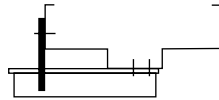
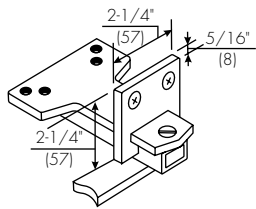
Exposed Back - #8545A Architectural Plastic or Architectural Metal Cover Decorative Back Plate: For use on doors with glass lights where a closer with an architectural plastic or metal cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

Exposed Back/Narrow Top Rail - #8548A Architectural Plastic or Architectural Plastic or Architectural Metal Cover Drop Plate: For use on doors with glass lights where a closer with an architectural plastic or metal cover is installed on a narrow top rail, and the back of the cover is exposed. This drop plate can be used to mount a closer on a top rail as narrow as 2-7/16" (62mm) in height. This plate covers the back of the installation to give a pleasing appearance from the reverse side.

UNITROL[®] ARM

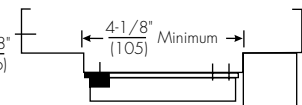
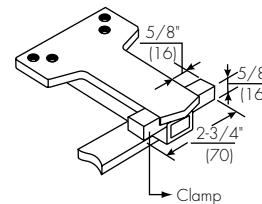
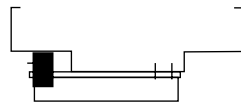
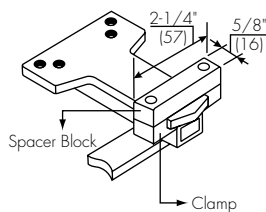
Closer Mounting Plate

Soffit Plate Reinforcing Brackets (for Parallel Arm)



Additional Support - #6190 Reinforcing Bracket: Standard for use with all parallel arm *Unitrol* door controls. Provides additional support to the soffit plate on installations with door frame reveals from 1-7/8" to 4-5/8" (48 to 117mm).

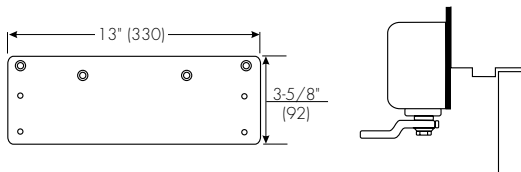
Flush Rabbeted Transom - #2022 Angle Bracket: Optional for use with all parallel arm *Unitrol* door controls. For use where rabbeted or flush transom conditions prevent installation of the soffit plate assembly. This bracket fastens to the overhead transom to provide a mounting surface for the soffit plate assembly.



Wide Frame - #6191 Reinforcing Kit: Optional for use with all parallel arm *Unitrol* door controls. Used to support the soffit plate on installations with wide frames. Clamps may be used with or without the spacer block, depending on frame conditions.

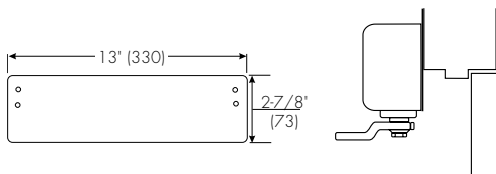
UNITROL® ARM

Closer Mounting Plates
Top Jamb

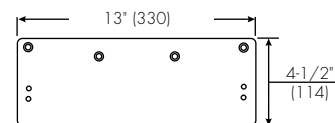


Narrow Top Rail - #8148 Drop Plate: For use where a narrow top rail prevents the closer from being mounted directly to the door surface. This drop plate can be used to mount a closer on a top rail as narrow as 2-7/16" (62mm) in height.

Full Cover Installations

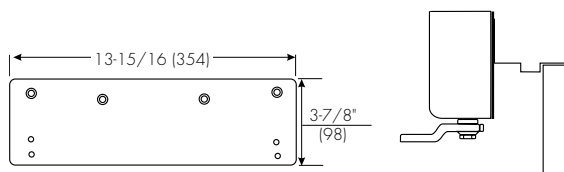


Exposed Back - #8445 Molded Full Cover Decorative Back Plate: For use on doors with glass lights where a closer with molded full cover is installed and the closer back is exposed. This plate covers the back of the installation to give a pleasing appearance from the reverse side.



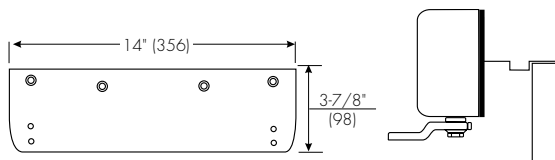
Exposed Back/Narrow Top Rail - #8158 Molded Full Cover Drop Plate: For use on doors with glass lights where a closer with molded full cover is installed and the back of the closer is exposed. This covers the back of the installation and gives a pleasing appearance from the reverse side.

Metal Cover Installations



Low Ceiling Clearance - Overhead Door Holder - #8547 Metal Full Cover Drop Plate: For use where a low ceiling clearance prevents normal top jamb mounting. This plate is used when the clearance is between 1-5/8" and 3-3/4" (41 and 95mm). Or for use where a surface or concealed overhead door holder prevents normal top jamb mounting of a closer with a metal full cover. This plate drops the closer and allows arm mounting screws to clear the bottom of the door holder. This places the centerline of the arm mounting screws at 3-7/8" (98mm) from the top of the door.

Architectural Plastic or Metal Cover Installations



Low Ceiling Clearance - Overhead Door Holder - #8547A Architectural Plastic or Architectural Metal Cover Drop Plate: For use where low ceiling clearance prevents normal top jamb mounting. This plate is used when the clearance is between 1-5/8" and 3-3/4" (41 and 95mm). Or for use where a surface or concealed overhead door holder prevents normal top jamb mounting of a closer with an architectural plastic or metal full cover. This plate drops the closer and allows arm mounting screws to clear the bottom of the door holder. This places the centerline of the arm mounting screws at 3-7/8" (98mm) from the top of the door.

7200 SERIES

Electromechanical
Closer/Holder



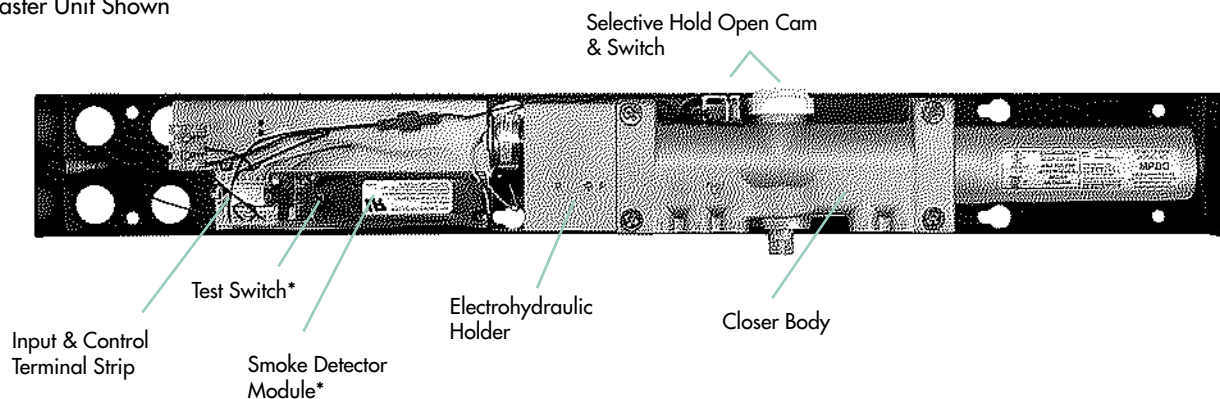
Norton[®]
ASSA ABLOY

ASSA ABLOY, the global leader
in door opening solutions

7200 SERIES ELECTROMECHANICAL CLOSER/HOLDER

OVERVIEW

Master Unit Shown



*Master Unit Only

BASIC UNITS

Master Unit: 7200MPDO

Consists of an on-board power supply (for 120VAC input option) or a terminal strip (for 24VDC input option), an integral smoke detector module and a door closer assembly with internal electro-hydraulic holder capability. A Master Unit can control a single door or one leaf of a pair of doors. A 24VDC Slave/Support Unit is required on the opposite door leaf.

Slave/Support Units: 7200MPSO

Identical in size to the Master Unit, the Slave/Support Unit consists of an on-board power supply (for 120VAC input option) or a terminal strip (for 24VDC input option) and a door closer assembly with internal electro-hydraulic holder capability. This unit (120VAC or 24VDC) is intended to control a single door or a pair of doors where the building's alarm system monitors the power to the Slave/Support Unit (24VDC input) or to control the inactive leaf of a pair of doors where the active leaf is controlled by a Master Unit.

Executive™ Unit: RFS Suffix

Identical in size and appearance to a Master Unit, the Executive Unit consists of an on-board power supply (for 120VAC input option) or a terminal strip (for 24VDC input option), a 433MHz radio frequency receiver and a door closer assembly with internal electro-hydraulic holder capability. Unit is intended to provide remote wireless release of a door that has been manually placed into the electrified hold open position. Not intended for use in life safety applications.

SPECIFICATIONS

Closer for _____ doors shall be electromechanical (with integral smoke detector) and completely enclosed in a metal cover. Units shall be surface mounted to the frame face [on the pull (hinge side) or the push (opposite hinge side)] of the door [and shall project no more than 2-11/16" (68mm) from the surface of the frame]. (Closer shall be installed in the header of the frame, and the slide track mortised into the door's top rail). Closer unit shall be hydraulic, full rack and pinion type with a cast aluminum alloy shell. Hydraulic fluid shall be non-gumming and non-freezing. Closer unit shall have two non-critical valves to independently regulate closing and latch speed. It shall also have an adjustable backcheck with a hex-key. Closer unit shall have spring power adjustment to permit a 50% increase in closing power over the minimum closing force for any size. Electromechanical Closer shall have (Infinite) (Selective) Hold Open (Free Swing Operation) and shall be able to attain a maximum opening of 180° (with hold open to 175°). Unit to be fail safe and must close the door during any electrical power interruption to the unit. (Closer/Holder to be Executive Door Holder/Release with release actuated by battery operated hand-held controller). Unit(s) to operate on (120VAC, 60Hz) (24VDC) and will accept (surface) (concealed) wiring. Amperage draw shall not exceed (.105 Amps for 24VDC) (0.46 Amps for 115VAC) units. Supplier to coordinate electrical requirements with electrical and alarm system engineers. Wiring (and conduit) by others.

Electromechanical Units to be Norton® Series 7200 (Closer/Holder) (Free Swing Releasing Device), (Executive Door Holder/Release).

FEATURES

Aluminum Alloy Housing

Closer bodies are constructed of a special aluminum alloy, carefully selected to accommodate interactive steel components and operating conditions.

Rack & Pinion Operation

Provides a smooth constant control of the door through its full opening and closing cycle.

Spring Sizes

Specify closer size 3, 4 or 5. Size 6 available with 7290 overhead concealed units.

Sweep Speed Control Valve

Allows adjustment of door speed from the door's full open position down to approximately 10° from the closed position.

Latch Speed Control Valve

Allows adjustment of door speed from approximately 10° down to the door's fully closed position.

Adjustable Backcheck Cushioning

Provides control of the door in the opening cycle, beginning at approximately 75° of door opening. It slows/cushions the door opening, when the door is forcibly opened beyond its pre-adjusted limits.

Adjustable Backcheck Position Valve

Allows the door opening position, where backcheck cushioning begins, to be adjusted to a greater door angle, up to a maximum of 20° farther (approximately 95°).

Handed

Specify right or left hand when ordering.

Selective Hold Open (Standard)

The door will hold open at any degree of opening beyond a pre-set hold open point, up to 175°, with a maximum allowable door opening of 180° (exception series 7250 at 110°).

Infinite Hold Open

The door will hold open at any degree of opening up to 175°, with a maximum allowable door opening of 180° (exception series 7250 at 110°). Can be set in the field by turning cam.

Fail Safe

In the event of a power failure, the solenoid will de-energize and the closer/holder will then operate as a normal door closer.

Wiring Option

All 7200 Series Electromechanical Closer/holders will accommodate either concealed or surface wiring.

Selective Hold Open Switch and Cam:

The Selective Hold Open starting point is determined by a switch and adjustment cam assembly. The cam is attached to the upper pinion shaft by means of a machine screw. As the door is opened, the pinion shaft will rotate the cam and operate the switch to the "on" position to initiate hold open. When the door is closed, the pinion cam will operate the switch to the "off" position. The cam is factory set to operate at 80° of door opening. The cam can be easily field adjusted to operate at virtually any degree of door opening.

UNITS WITH DETECTORS

Fire/Smoke Control Circuit:

Interprets the signal from the detector and provides switching contacts to interrupt hold open solenoid, to sound alarms, etc.

Alarm (Relay) Contacts:

Normally open in standby condition (operating and sensing for smoke condition). These contacts close during an alarm condition (smoke detected) and may be used to switch power from the solenoid to an optional local alarm.

Trouble (Relay) Contacts:

Normally closed in standby condition, these supervisory contacts monitor the continuity of power within the detector circuit. Any power interruption within the detector circuit will open these contacts. They can then be used to simultaneously indicate a Trouble Condition to the Alarm Panel on a separate trouble circuit.

Locked-In Alarm:

The unit which alarms must be manually reset. This can be accomplished by remote control from the alarm system panel or by the reset switch in the smoke detector module. Reset switch is accessible through the center louver in the cover. Reset by rotating LED chambers using small flat blade screwdriver.

Indicator Lights:

Normal Mode: A red LED flashes once every eight (8) seconds.

Clean Mode: A red LED flashes once every second.

Alarm Mode: A red LED illuminates continuously.

Test Switch:

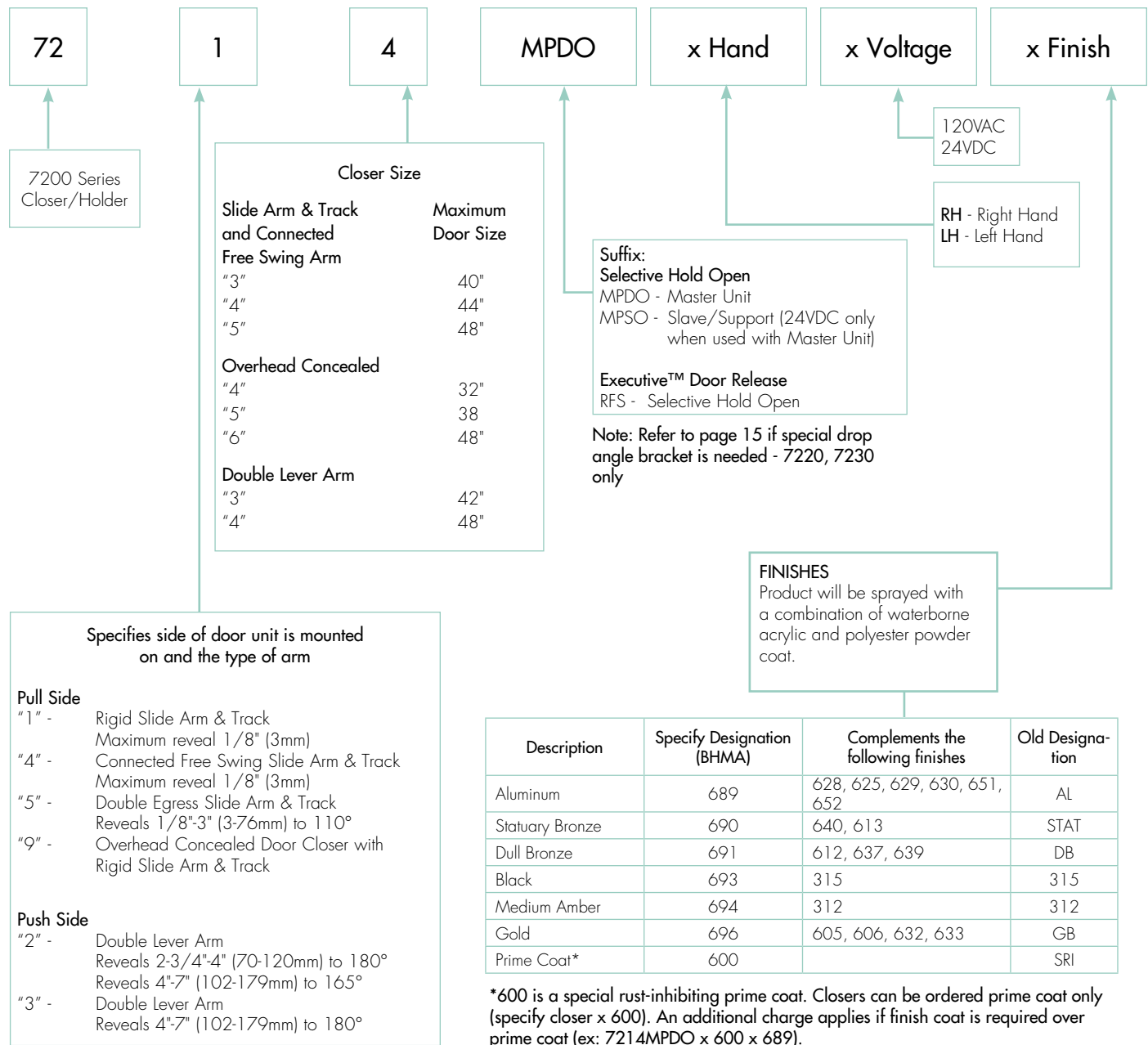
Permits door to be released from hold open without causing a "trouble condition" at the alarm panel. Allows for periodic testing of the automatic door release function.

7200 SERIES ELECTROMECHANICAL CLOSER/HOLDER

COMPLIANCE STANDARDS

- ANSI/BHMA A156.15 certified **BHMA** certified
- UL / cUL listed for use on fire rated doors **UL**
- UL10C listed for positive pressure fire test
- This product is manufactured in an ISO 9001 facility

HOW TO ORDER



MASTER UNITS

7210/7250

- Surface mounted to the pull (hinge) side frame face
- Slide track mounts directly to door
- Minimum 4" ceiling clearance required
- 1/8" (3mm) – standard frame reveal. For deeper reveals, a special slide arm is required (see chart on page 7).
- Handed
- Standard units accommodate doors opening 180°; maximum 175° hold open
- Buffer block assembly in the track will accommodate doors opening to 125°
- Auxiliary door stop is required for doors opening beyond 125°
- Units shipped Selective Hold Open; Infinite Hold Open can be set in the field.
- Fail Safe – solenoid will de-energize in the event of power failure
- Accommodates either concealed or surface wiring



7210MPDO Shown

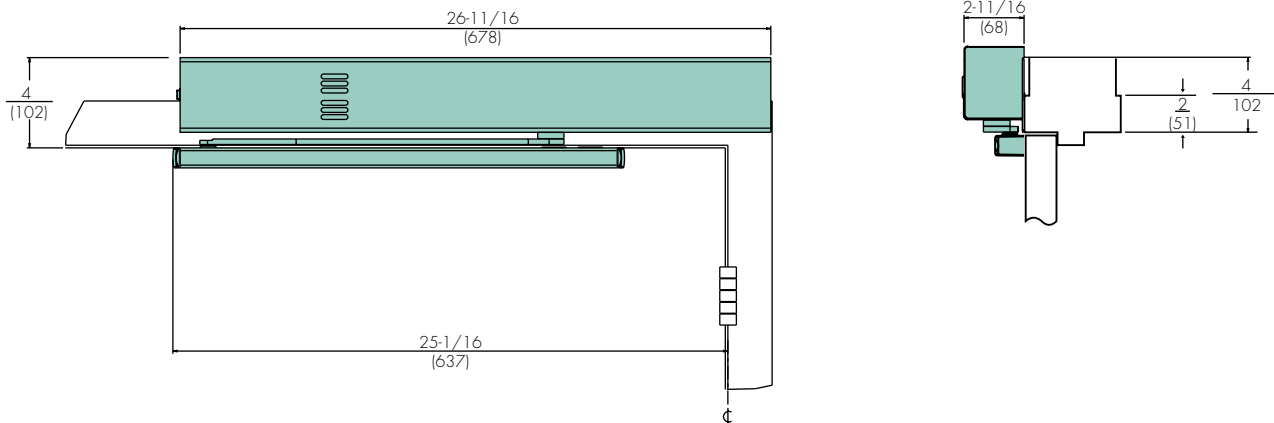
Single Doors:

- **Master Units with Integral Smoke Detector:**
 Both Series 7210MPDO or 7250MPDO are self-contained and can be installed to control a single door.
- **Executive™ Door Holder/Release:**
 Both Series 7210RFS or 7250RFS are self-contained and can be installed to control a single door.

Pair of Doors:

- **Master Unit x Slave/Support Unit:** Smoke Detector in the Master Unit controls the Closer/Holder solenoid in both the Master Unit and the Slave/Support Unit.

MASTER UNITS



SLAVE/SUPPORT UNITS

7210/7250

- Surface mounted to the pull (hinge) side frame face
- Slide track mounts directly to door
- Minimum 4" ceiling clearance required
- 1/8" (3mm) – standard frame reveal. For deeper reveals, a special slide arm is required (see below).
- Handed
- Standard units accommodate doors opening 180°; maximum 175° hold open
- Buffer block assembly in the track will accommodate doors opening to 125°
- Auxiliary door stop is required for doors opening beyond 125°
- Units shipped Selective Hold Open; Infinite Hold Open can be set in the field.
- Fail Safe – solenoid will de-energize in the event of power failure
- Accommodates either concealed or surface wiring

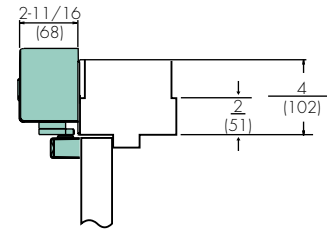
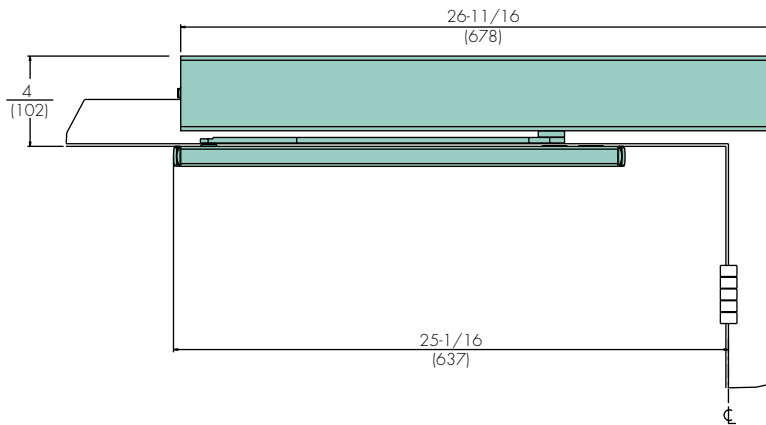


7210MPSO Shown

Pairs of Doors:

- **Master Unit x Slave/Support Unit:** Smoke Detector in the Master Unit controls the Closer/Holder solenoid in both the Master Unit and the Slave/Support Unit.

TECHNICAL DETAILS



Maximum Door Size (cm)	Model Number	
	Standard Reveal (to 1/8" (3mm) reveal)	Deep Reveal (see note)
40" (102)	7213MPSO	7253MPSO
44" (112)	7214MPSO	7254MPSO
48" (122)	7215MPSO	7255MPSO

Note: Deep Reveals

- Special slide arm is available for reveals in excess of 1/8" (3mm) up to 3" (76mm), 7250MPSO series
- 110° maximum door swing

Contact factory if door weight exceeds 250 lbs.

ELECTRICAL DATA

Series Number	Suffix	Operating Voltage (Input)	No. Power Input Lines* (Pairs)	Amperage Draw	(Can be) Used with Master Unit
				Solenoid Coil	
7210	MPSO	24VDC (only)	1	.070@ 24VDC	7210MPDO-24
7250		24VDC supplied from Master Unit			7250MPDO-24
					7210MPDO-120
					7250MPDO-120

*Max/Min Operating Voltage Parameters +10% / -15%



Full-featured operator with slim profile
for moderate to high traffic applications

6300 S E R I E S

LOW ENERGY OPERATOR

CATALOG

Norton[®]

ASSA ABLOY

ASSA ABLOY, the global leader
in door opening solutions

INTRODUCTION

The Norton 6300 Series Low Energy Operator offers a broad set of intelligent functions, such as latch boost, latch retraction and obstruction detection to safely secure a variety of **moderate to high traffic openings**. A unique design with one of the slimmest profiles available allows the 6300 to blend more seamlessly with the frame while fitting challenging applications with minimal header space. A modular design and simple controls also make for easy installation and setup.



FEATURES

- » Push and pull side mounting
- » Non-handed
- » Activated by push button, hands-free and RF devices
- » Door size: min width 36", max width 48", max weight 200 lbs.
- » Power assist
- » Push and go (selectable)
- » Obstruction detection (open and close)
- » Aesthetically pleasing, slim profile
- » Modular design
- » Latch assist feature for enhanced security
- » Latch boost
- » Selectable mode switch (off, on, hold open)
- » Adjustable opening force
- » Adjustable closing power
- » Blow open and blow close for smoke ventilation
- » 2 year limited warranty

SMART

- » Latch boost ensures door closes to secure facility
- » Occupant safety enhanced by obstruction detection, power assist, and push and go functions
- » Inputs available for security override and fire safety

SIMPLE

- » Modular, four-piece design allows for one-person installation
- » Heavy-duty back plate serves as template simplifying and speeding installation
- » Unit learns door properties (approximate weight) during installation for easy programming and set-up
- » Easy to use controls simplify setup
- » USB port allows for quick software updates

GOOD LOOKING

- » Unique design with slim profile blends seamlessly with frame
- » Low profile easily fits applications with minimal header space

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FUNCTIONS

- » Power Assist
 - › Senses the door is being opened manually and applies small amount of power to assist user in opening the door with force less than 5 lbs.
 - › Door opens only as far as it is moved manually, then closes once released
- » Push and Go (selectable)
 - › As the door is manually opened, the operator “senses” movement and opens door to the full-open position
- » Obstruction Detection
 - › Open
 - › Door closes if it hits an obstruction while opening
 - › Close
 - › Door will reverse to open position if it hits an obstruction while closing
 - › Close (Selectable - Stop on Stall)
 - › Door will stop once it hits an obstruction and will rest against the obstruction until removed
- » Motor Startup Delay
 - › Delays operator opening for locking hardware
- » Infinite Hold Open
 - › Door will hold open at set position until power is turned off
- » Latch Boost (Selectable)
 - › Additional closing force to overcome conditions that might otherwise prevent the door from latching (ex: weather stripping, stack pressure)
- » Selector mode switch (3 position)
 - › Off - door functions as a standard door closer
 - › On - door functions as an automatic low energy operator
 - › Hold Open - activates the unit to the hold open position

SPECIFICATIONS

Door Control (interior) (exterior) closing force shall be adjustable to ensure adequate closing control. Door Operator shall simulate conventional door closer opening and closing forces unless the power operator motor is activated. Door Operator shall have electronic backcheck to cushion the door speed if door is opened violently. [(Door Operator shall be AUTOMATICALLY ACTIVATED by either a slight push or pull in the direction of opening swing - Push and Go.) (Door Operator shall be SELECTIVELY ACTIVATED by external initiating device, i.e. wall switch, etc.) (Door Operator shall be both AUTOMATICALLY ACTIVATED and SELECTIVELY ACTIVATED.)] Operator shall have selectable latch boost to provide additional closing force to overcome conditions that may prevent door from latching. Unit shall have delay switches for motor activation, electric lock interfacing, and hold open time. Units shall interface with latch retraction exit devices or similar products and have 24VDC @ 1.3A maximum (less accessories) output for connection of electric strike, lock, radio frequency receiver, etc. Unit shall have a three-position Selector Mode Switch that will permit the unit to be switched "ON" to monitor for function inputs, switch to "H/O" for infinite hold open function or switched "OFF" which will disable function inputs allowing unit to be used as a manual door closer. Unit shall be U.L. Listed for automatic closing door. The Unit shall be adjustable to provide compliance with the requirements of the Americans with Disabilities Act (ADA). Unit shall be certified by BHMA to meet A156.19 requirements. Unit shall meet UL325/991, UL10C standards.

ELECTRICAL DATA

- » Power input 120 VAC, 3A, 60Hz
- » Current draw 1.5A
- » Power output 24VDC @ 1.3A max draw (less accessories)

CERTIFICATIONS

- » ANSI/BHMA A156.19 certified **BHMA** CERTIFIED
- » UL325/991 certified
- » UL10C listed for positive pressure fire test
- » Complies with requirements for the Americans with Disabilities Act (A.D.A)
- » Manufactured in an ISO 9001 and ISO 14001 certified facility

APPLICATIONS

6311 Shown

HINGE (PULL) SIDE OF DOOR
RIGID ARM AND SLIDE TRACK



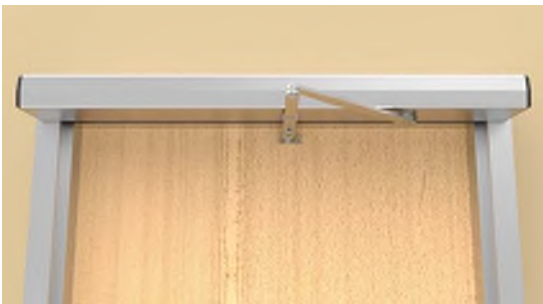
6350 Shown

DOUBLE EGRESS ARM (PULL) SIDE OF DOOR

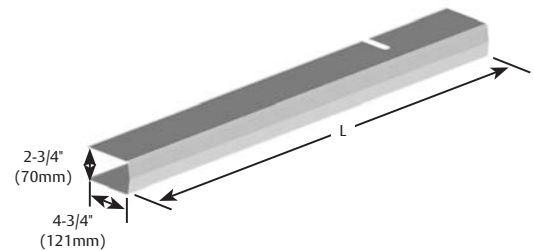


6330 Shown

STOP (PUSH) SIDE OF DOOR
STANDARD-DUTY DOUBLE LEVER ARM



6341 - can be mounted on the pull or push side of the door.



Model	Mounting		Arms			Overall Length (L)	Compatible with 585 Presence Detector	Cover spans full frame (36" door only)	Can be used on a pair of 36" doors
	Pull Side	Push Side	Rigid Arm & Slide Track	Double Lever	Double Egress				
6310	•		•			39-5/8"	No	Yes	No
6330		•		•					
6350	•				•				
6311	•		•			37-3/8"	Yes	No	Yes
6331		•		•					
6341	•	•	•	•					
6351	•	•			•				

6300 SERIES LOW ENERGY POWER OPERATOR

Model	Door Opening	Reveal Range	Minimum Top Rail	Minimum Ceiling Clearance*	Frame Width	Door Width	Door Weight
6310 6311	Up to 180°	1/8"	1-1/8"	2-1/4" standard; 1-1/2" with field modification^	Minimum 2"	Minimum 36" Maximum 48"	200 lbs
6330 6331	110° to 135° (depending on reveal)	1/8" to 6-3/4"	2-1/4"	5/8" standard; 0" with field modification^			
6341	Refer to 6311 or 6331 information						
6350 6351	Up to 130°	1/8" to 2-3/4"	1-1/2"	2-1/4" standard; 1-1/2" with field modification^			

*Based on units mounted on 2" frame

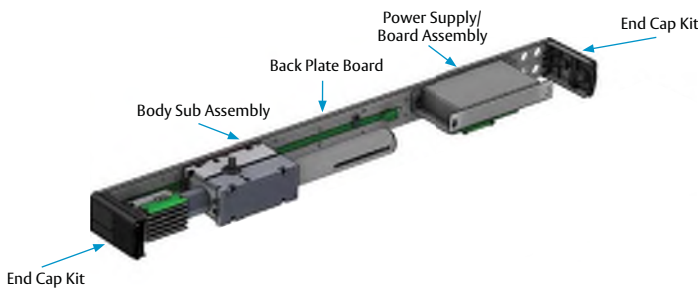
^Consult factory

Notes:

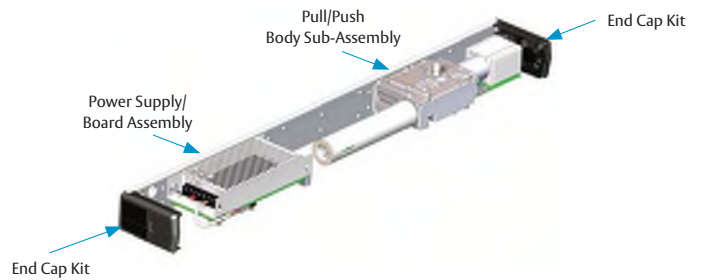
- › For additional information, the 6300 Series Instruction Manual is available online.
- › Contact factory if door weight exceeds 200 lbs.

PARTS LIST

6310, 6330



6311, 6331



Unit Sub-Assembly

Part Number	Description	For Model's
6310LAP	Pull Body Sub-Assembly	6310, 6350
6330LAP	Push Body Sub-Assembly	6330
6300BPB	Back Plate Board	6310, 6330, 6350
6300CM	Power Supply / Board Assembly	6310, 6330, 6350
6300CAB	Cable Kit	6310, 6330, 6350
6300LAP	Pull/Push Body Sub-Assembly	6311, 6331, 6341, 6351
6300CM2	Power Supply / Board Assembly	6311, 6331, 6341, 6351
6300CAB2	Cable Kit	6311, 6331, 6341, 6351

Miscellaneous Parts

Part Number	Description	For Model's
6300END	End Cap Kit (included both end caps)	All models
6300SP	Screw Pack	All models
6300COV	39-5/8" Cover	6310, 6330, 6350
6300COV2	37-3-8" Cover	6311, 6331, 6341, 6351

ARM AND TRACK ASSEMBLIES



- 6310-1 Arm and Track Assembly
- 6310-1W Arm Assembly
- 7100-1T Track Assembly



- 6330-1 Arm Assembly
- 6330-1W Main Arm & Rod
- 6620-12 Adjusting Tube & Shoe



- 6350-1L Arm and Track Assembly (LH)
- 6350-1R Arm and Track Assembly (RH)
- 6350-1LW Arm Assembly (LH)
- 6350-1RW Arm Assembly (RH)
- 7100-1T Track Assembly

OPERATIONAL SIGNAGE

679 Signage Kit (supplied standard)



(1 per switch)

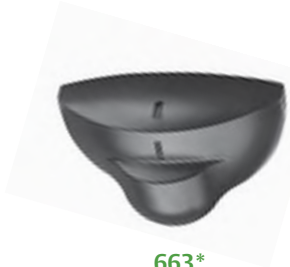


(1 per switch)



(2 per operator)

ACCESSORIES



663*

Motion Sensor

- » 4-3/4" x 3-3/16" x 2" projection
- » Unidirectional
- » Black cover
- » SPDT relay
- » Adjustable angle pattern
- » 24 VDC input
- » Must not be placed where motion of door can be sensed



500 & 530

Switch Post

- » 4" x 6" x 40" x 3/16" wall thickness
- » 9 volt battery
- » RF temperature range: -4° F to 122° F
- » 689 (aluminum) or 690 (dark bronze) finishes; specify when ordering
- » Standard formed plastic cap
- » Surface mounted (above ground)
- » 530 – radio frequency transmitter
- » 500 – hard wired switch
- » 530POST – post only; switch not included



585

Presence Detector

- » Diffused active infrared technology
- » 11.8" l x 1.9" h x 1.9" w
- » Black anodized aluminum
- » 9"x0" maximum mounting height
- » Supply voltage: 24VAC/DC

EXECUTIVE PACKAGE



5900EXPG

(includes receiver 539 and transmitter 536)



Radio Frequency Receiver 539

- » 433 MHz

539



536

Transmitters

- » 2-3/8"w x 4-3/16"h x 15/16"d
- » Single channel



538

- » 2-3/8"w x 4-3/16"h x 15-16"d
- » Two channel



548

- » Converts existing hard wired push plates to work with RF receivers offered after June 2013
- » Single channel
- » 9 volt

* Use of motion sensor must be approved by local authority having jurisdiction.

^ Provides auxilliary contacts for latch retraction (exit devices). Consult Norton Technical Product Support.

ACCESSORIES



501 502

Activating Door Switches

- » 4-1/2" W. x 4-1/2" H.
- » 15 amp @ 125 VAC
- » Flush mounted – hard wired
- » Fits single or 2 gang electrical box
- » 501 – Stainless steel with black letters
- » 502 – Blue powder coat with white letters
- » Specify #542 to order surface mount box for 501 or 502 switch



504

Vestibule Switches

- » 5" W. x 4-3/4" H.
- » 2 – SPDT UL listed switches-mom.
- » 15 amp @ 125 VAC
- » Fits 2-gang electrical box
- » Stainless steel with blue letters



505, 531 507, 532

Activating Door Switches

- » 6" W. x 6" H.
- » 9 volt battery
- » 15 amp @ 125 VAC
- » Flush mounted
- » Stainless steel with blue letters
- » 531, 532, 533 and 535 radio frequency (433MHz). Used with RF option and 539. Supplied with surface mount boxes.
- » 507, 505, 506 and 534 hard wired*. Surface mounted boxes are not supplied. If required, specify:
555 - 6" square surface mount box
557 - 6" round surface mount box



506, 533 534, 535



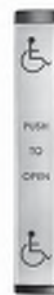
700

Wave-to-Open Wall Switch

- » Single gang and double gang packaged together
- » Sensor requires movement for activation
- » Variable relay – hold time from 0 – 35 seconds
- » Range 0" to 4"
- » 3" W x 4-3/4" H (single);
- » 4-1/2" W x 4-1/2" H (double)

Low Profile Push Plate

- » 36" x 6" activation zone
- » 1" low profile depth
- » Stainless steel face plate
- » Adapts to either wireless or hardwired installations
- » 638 - Wireless
- » 639 - Hardwired



638, 639

* Switches may also be installed with single or double gang electrical box using fasteners included.



503

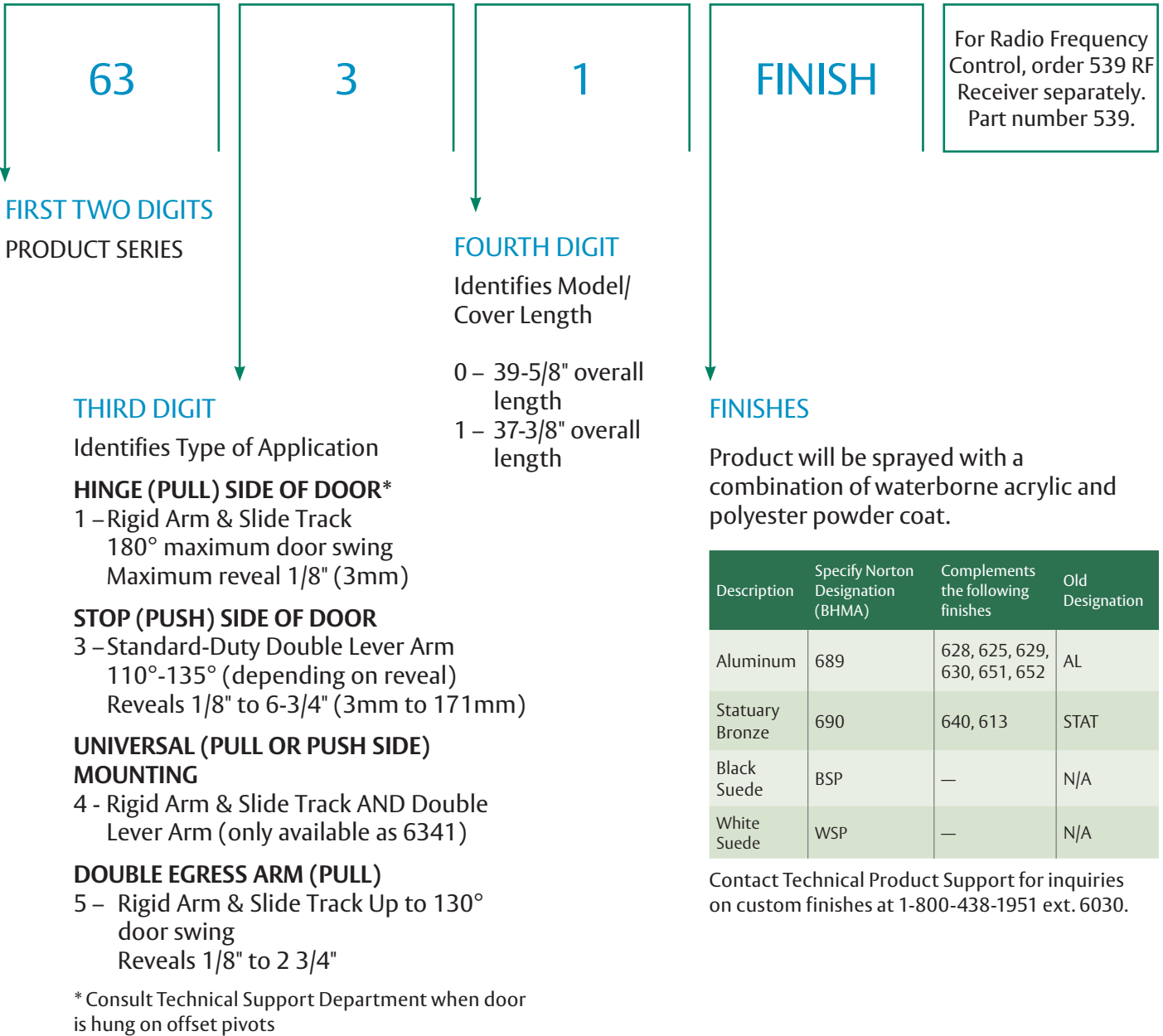
Vestibule Switches

- » 1-1/2" x 4-3/4" face plate
- » SPDT UL listed switch-mom.
- » 15 amp @ 125 VAC
- » Fits 1-3/4" frame
- » Stainless steel with blue letters

All hard wired switches are Momentary Contact SPDT, UL Listed. Optional DPDT switches are available; suffix "D" to model number.

HOW TO ORDER

Note: All transmitters (door switches or key fob) must be ordered separately.



ASSA ABLOY is the global leader in door opening solutions, dedicated to satisfying end-user needs for security, safety and convenience

Since 1880, Norton door controls have been an integral part of schools, hospitals and businesses around the globe. When you need products and people that perform at the highest level, rely on Norton – From Open to Close.

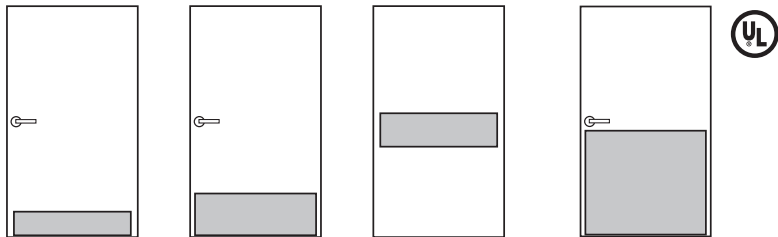
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3000 Highway 74 East | Monroe, NC 28112 | Tel: 1-877-974-2255 | Fax: 1-800-338-0965

ASSA ABLOY Door Security Solutions Canada | www.assaabloydss.ca

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Mop Plate
Up to 6" h x 48" w

Kick Plate
6" to 12" h x 48" w

Stretcher Plate
6" to 12" h and up
to 48" w

Armor Plate
Up to 48" h x 48" w and
available in most finishes



Width of Plates:

Push Side: 2" less than door width.

Pull Side: 1 1/2" less than door width.

NFPA 80 STANDARDS — 2-4.5 Protection Plates:

Factory-installed protection plates shall be installed in accordance with the listing of the door. Field-installed protection plates shall be labeled and installed in accordance with their listing.

Exception: Labeling is not required where the top of the protection plate is not more than 16" (406 mm) above the bottom of the door.

OPTIONAL Self-Drilling TEK Screws: Cuts door plate installation time in half.

Metal Door Plate – Economy Duty No. K1038

Material: .038" aluminum, stainless steel

Finishes: US32D

Fastener: #6 x 5/8" OH SMS

Ordering: Specify height x width x finish code. Add any options

Weight: 8" x 34" = 3.2 lbs

Options:

- SA – self-adhesive mounting
- TORX – security Torx screws
- TEK – self-drilling screws
- Cutouts for locks, louvers, or windows (see worksheets on pages C14-C15 for details on how to order)

Metal Door Plate - Standard Duty No. K1050

Material: .050" Stainless Steel

Finishes: US32D

Fastener: #6 x 5/8" OH SMS

Ordering: **Size** **High** **Width**

8x34BEV.32D 8" 34"

10x34BEV.32D 10" 34"

34x34BEV.32D 34" 34"

Options:

- Beveled Edge and Counter Sink included
- One day shipping available
- Door markings are not available on quick ship

Metal Door Plate – Standard Duty No. K1050, K1050F

Material: .050" aluminum, brass, bronze, stainless steel

Finishes: US10BE, US32D, US32DMS

Fastener: #6 x 5/8" OH SMS

Ordering: Specify height x width x finish code. Add any options

Weight: 8" x 34" = 4.0 lbs

ANSI: J101 - metal armor plate, J102 - metal kick plate, J103 - metal stretcher & mop plate

Options:

- SA – self-adhesive mounting
- TEK – self-drilling screws
- Beveled 3 or 4 edges, specify B3E or B4E
- Cutouts for locks, louvers, or windows (see worksheets on pages C14-C15 for details on how to order)
- Heavy bevel available, specify HVBEV
- Screw mounting (K1050F) and UL listed for use on 90-minute label wood doors and 3-hour label metal doors
- CSK – countersunk holes
- TORX – security Torx screws

Windstorm Plate – K1050WS

Material: .050" Aluminium, Brass, Bronze, Stainless Steel

Finishes: Standard Architectural Finishes

Fastener: #10x5/8" Pan Head Tek Screws

Ordering: Part # when ordering is K1050WS

All plates are UL and Windstorm rated

Options:

- Cutouts for locks, louvers or windows
- Rounded Corners
- Heavy Bevel
- Screw Mount only



Certified to the below standards:

- ICC-500 (2014)

- FEMA Guideline 320 (2014)

- FEMA Guideline 361 (2015)

Part of windstorm assembly cards: ZHLA.45, ZHLA.46, ZHLA.47, ZHLA.51, ZHLA.53, ZHLA.54

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Opening Solutions

Experience a safer
and more open world



Heavy Duty Door Stop No. 466

- Material:** Flame resistant molded rubber bumper
- Finishes:** Black
- Mounting:** Drill 1" dia. x 2 1/2" deep hole, fill with anchoring grout
- Features:**
- Ideal for use in high vandalism or security areas
 - No exposed fasteners

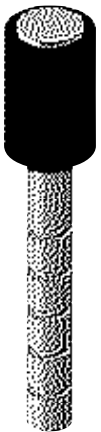
No.	Diameter	Height	Mounting Bolt	Weight
466	2" dia.	x 1 1/2" h	5/8" x 2 1/2"	0.6 lbs.



Heavy Duty Door Stop No. 467

- Material:** Flame resistant molded rubber bumper
- Finishes:** Black
- Mounting:** Drill 1" dia. x 2 1/2" deep hole, fill with anchoring grout
- Features:**
- Suitable for concrete floor or wall mounting
 - Ideal for use in high vandalism or security areas
 - No exposed fasteners
 - Accepted by the New York State Office of Mental Health (OMH) for use in high risk areas

No.	Diameter	Height	Mounting Bolt	Weight
467	2" dia.	x 3 1/2" h	5/8" x 2 1/2"	0.9 lbs.



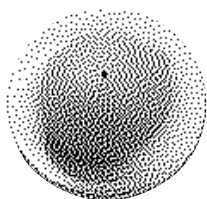
Heavy Duty Door Stop No. 468

- Material:** Wrought stainless steel and black rubber bumper
- Finishes:** US32D
- Mounting:** Drill 1 1/2" dia. x 7" deep hole, fill with anchoring grout
- Features:**
- Ideal for use in high vandalism or security area
 - No exposed fasteners
 - Accepted by the New York State Office of Mental Health (OMH) for use in high risk areas

No.	Diameter	Height	Mounting Bolt	Weight
468	2" dia.	x 3" h	1" x 7"	2.6 lbs.

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The global leader in
door opening solutions



Solid Cast Wall Stops No. 400, 401, 402

- Material:** Cast brass with DuraFlex bumper
Finishes: Available in standard architectural finishes (see page 9)
Features: Concealed mounting, convex bumper. Back plate prevents damage to wall

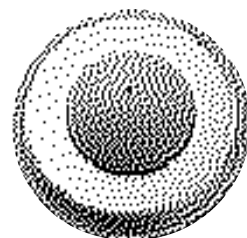
No.	Bumper	Fastener	Size	Projection	Weight	ANSI A156.16
400	Convex	#6 x 1 1/2" FH SMS, plastic toggle	2 7/16" dia.	1"	3.3 lbs./10	L02101
401	Convex	#8 x 1" RH WS, plastic anchor	2 7/16" dia.	1"	3.3 lbs./10	L02101
402	Convex	#8 - 32 x 1" TH MS, lead anchor	2 7/16" dia.	1"	3.3 lbs./10	L02101



Solid Cast Wall Stops No. 403, 404, 405

- Material:** Cast brass with DuraFlex bumper
Finishes: Available in standard architectural finishes (see page 9)
Features: Concealed mounting, concave bumper. Back plate prevents damage to wall

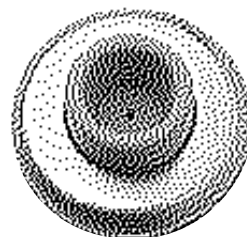
No.	Bumper	Fastener	Size	Projection	Weight	ANSI A156.16
403	Concave	#6 - 1 1/2" FH SMS, plastic toggle	2 7/16" dia.	1"	3.3 lbs./10	L02251
404	Concave	#8 x 1" RH WS, plastic anchor	2 7/16" dia.	1"	3.3 lbs./10	L02251
405	Concave	#8 - 32 x 1" TH MS, lead anchor	2 7/16" dia.	1"	3.3 lbs./10	L02251



Wrought Wall Stops No. 406

- Material:** Wrought brass, bronze, and stainless steel with DuraFlex bumper
Finishes: Available in standard architectural finishes (see page 9)
Features:
 - Concealed mounting, convex bumper. Back plate prevents damage to wall
 - Accepted by the New York State Office of Mental Health (OMH) for use in high risk areas

No.	Bumper	Fastener	Size	Projection	Weight	ANSI A156.16
406	Convex	#8 x 1 1/4" TH SMS, plastic toggle	2 1/2" dia.	3/4"	1.8 lbs./10	L02101



Wrought Wall Stops No. 409

- Material:** Wrought brass, bronze, and stainless steel with DuraFlex bumper
Finishes: Available in standard architectural finishes (see page 9)
Features:
 - Concealed mounting, concave bumper. Back plate prevents damage to wall
 - Accepted by the New York State Office of Mental Health (OMH) for use in high risk area**Options:** DuraFlex bumper available in standard gray or optional black

No.	Bumper	Fastener	Size	Projection	Weight	ANSI A156.16
409	Concave	#8 x 1 1/4" TH SMS, plastic toggle	2 1/2" dia.	3/4"	1.8 lbs./10	L02251

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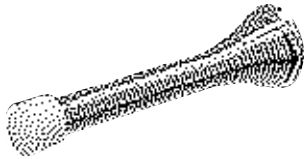
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Spring Base Door Stop No. 525

- Material:** Spring steel
Finishes: Antique brass (ANT), bright brass (BRS), bright nickel (NP)
Features: Heavy spring construction for durable wear

No.	Fastener	Base	Projection	Weight	ANSI A156.16
525	6x ³ / ₄ " SMS	1" dia.	3"	0.7 lbs./10	L02051



Spring Base Door Stop No. 526

- Material:** Spring steel
Finishes: Bright brass (BRS), bright nickel (NP)
Features: Heavy spring construction for durable wear

No.	Fastener	Base	Projection	Weight	ANSI A156.16
526	6x ³ / ₄ " SMS	1" dia.	4"	0.8 lbs./10	L02061



Heavy Duty Hinge Pin Stop No. 528

- Material:** Wrought steel with rubber bumpers
Finishes: Antique brass (ANT), bright brass (BRS), bright nickel (NP)
Features:
 - Positive slip proof adjustment
 - Heavy wrought steel construction works with both ¹/₄" and ⁵/₁₆" hinge pins

No.	Door Opening Adjustment	Weight	ANSI A156.16
528	70° to 100°	1.3 lbs./10	L02223

ASSA ABLOY

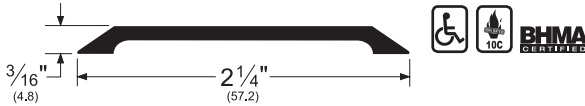
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Saddle Thresholds

- To use a saddle threshold in an offset condition, use an elevator (see page 135)

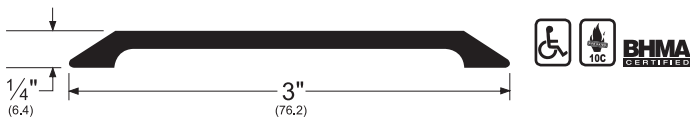
173_

AVAILABLE FINISHES: **10BE, A, B, BSP, D, G, WSP**
 ANSI (aluminum): **J32300, J32330**
 ANSI (brass): **J12300, J12330**



151_

AVAILABLE FINISHES: **10BE, A, B, BSP, D, G, WSP**
 ANSI (aluminum): **J32300, J32330**
 ANSI (brass): **J12300, J12330**



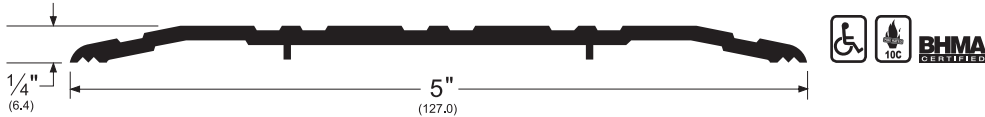
270_

AVAILABLE FINISHES: **10BE, A, B, BSP, D, G, WSP**
 ANSI (aluminum): **J32100, J32130**
 ANSI (brass): **J12300, J12330**



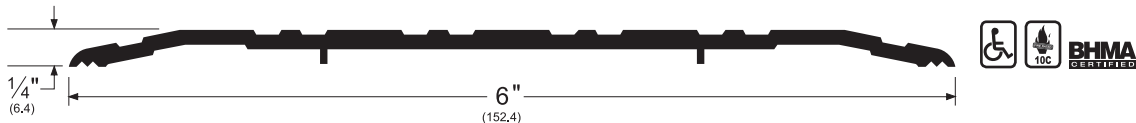
271_

AVAILABLE FINISHES: **10BE, A, B, BSP, D, G, SN, WSP**
 ANSI (aluminum): **J32100, J32130**
 ANSI (brass): **J12100, J12130**



272_

AVAILABLE FINISHES: **10BE, A, B, BSP, D, G, SN, WSP**
 ANSI (aluminum): **J32100, J32130**
 ANSI (brass): **J12100, J12130**



NOTE: Products shown in this section may not be drawn to scale.

AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
10BE (Stain Bronze Powder Coated Aluminum) **A** (Mill Finish Aluminum) **B** (Mill Finish Extruded Bronze [Brass])
BSP (Black Suede Powder Coated Aluminum) **D** (Dark Bronze Anodized) **G** (Gold Anodized)
SN (Satin Nickel Anodized) **WSP** (White Suede Powder Coated Aluminum)

NOTE: **G, SN** are available with limited inventory

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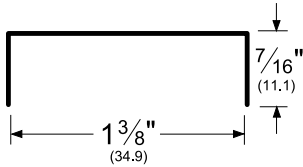
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Door Top Weatherstrip

_343

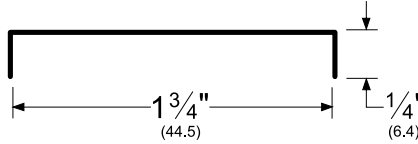
AVAILABLE FINISHES: **PA**
AVAILABLE LENGTHS: **36", 48"**

- For top of 1³/₈" wood doors



_344

AVAILABLE FINISHES: **PA**
AVAILABLE LENGTHS: **36", 48"**



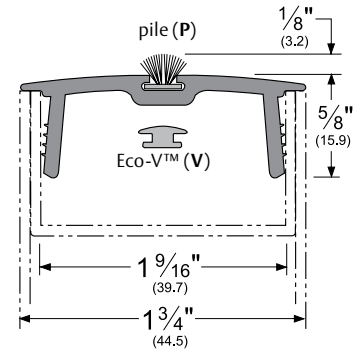
377VP_

REPLACEMENT INSERT: **P2 (BL, GR)**

377V_

REPLACEMENT INSERT: **EV38 (Tan)**

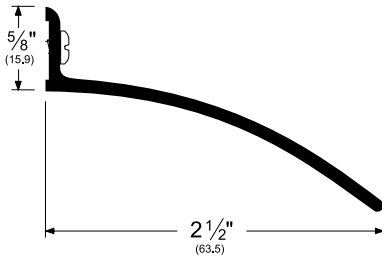
Rigid tan colored Eco-V™ with Eco-V™ (V) insert or pile (P) insert used as a door top (or bottom) filler strip for hollow metal doors



346_

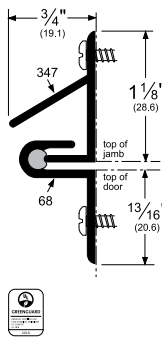
AVAILABLE FINISHES: **C, D, G, PW**

- Overhead rain drip with slotted holes
- Should be ordered a minimum of 4" longer than the door width



347_

AVAILABLE FINISHES: **A, D, G**



Heavy Duty Door Bumper

- Heavy duty door bumper extruded from black EPDM (E)
- Order 196_ separately; furnished undrilled unless requested otherwise

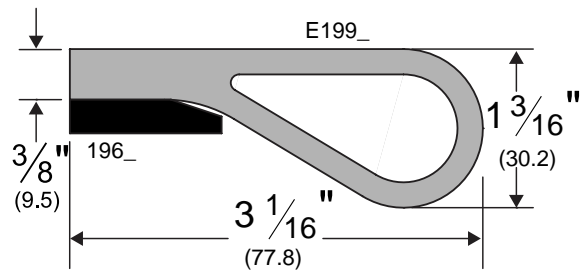
E199_

AVAILABLE COLOR: **BL**



196_

AVAILABLE COLOR: **A**



NOTE: Products shown in this section may not be drawn to scale.

AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
A (Mill Finish Aluminum) **C** (Clear Anodized) **D** (Dark Bronze Anodized) **G** (Gold Anodized) **PA** (Painted Aluminum)
PW (Painted White)

Non-Metal Finish: **BL** (Black)

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Kerf-In Weatherstrip (Cont.)

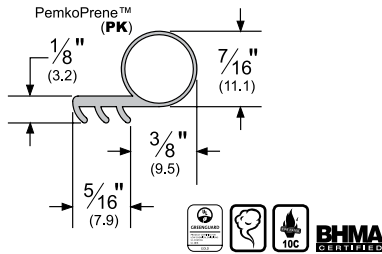
PK52

AVAILABLE FINISHES: **BL, W**

ANSI: **ROG154**

AVAILABLE LENGTHS: **18', 20', 300'**

- Minimum space between the door face and the stop is $\frac{1}{16}$ "; maximum space is $\frac{3}{8}$ "

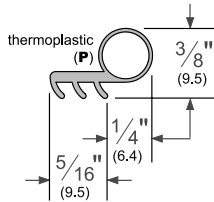


P50

AVAILABLE FINISHES: **BL, W**

AVAILABLE LENGTHS: **17', 25', 250'**

- Minimum space between the door face and the stop is $\frac{1}{16}$ "; maximum space is $\frac{1}{16}$ ".
- Thermoplastic elastomer formulation will not transmigrate; remains flexible to -60°F

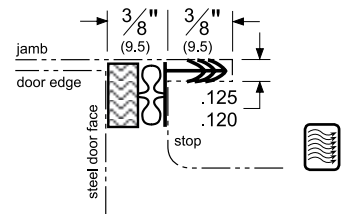


MAG349

AVAILABLE FINISHES: **D, W**

AVAILABLE LENGTHS: **37", 85", 96", 121"**

- Minimum space between the door face and the stop is $\frac{3}{16}$ "; maximum space is $\frac{7}{16}$ "
- Magnetic kerf-in weatherstrip features a magnetic strip encased by a UV-stable TPE cover
- Use for steel-faced door and wood frame applications
- Can be trimmed in the field and corner-mitered

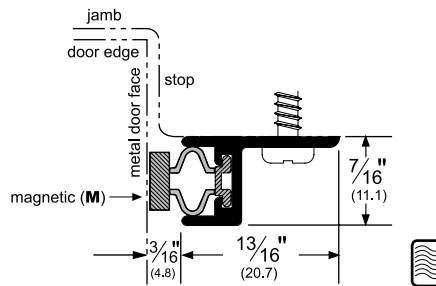


Magnetic Kerf-In Weatherstrip

2815_M

AVAILABLE FINISHES: **C, D, G**

REPLACEMENT INSERT: **2815MAG**



Adhesive Perimeter Gasketing

For more information on these perimeter gasketing products, please see the Adhesive Gasketing section.

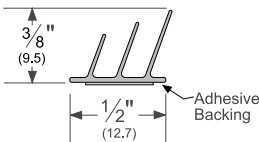
S773

AVAILABLE FINISHES: **BL, D, GR, W**

AVAILABLE LENGTHS: **17', 18', 20', 21', 25', 30', 250', 500'**

ANSI: **ROE154, ROE155**

- Triple-fin design blocks light and sound from infiltrating a room
- Product designed as hospitality gasketing (see more hospitality products in the Hospitality Products section)
- Seal begins compressing at $\frac{3}{8}$ "; compresses to seal up to a $\frac{1}{16}$ " gap



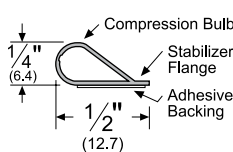
S88

AVAILABLE FINISHES: **BL, C, D, GR, TAN, W**

AVAILABLE LENGTHS: **17', 18', 20', 21', 25', 30', 204', 510'**

ANSI: **ROE154, ROE155**

- Seal begins compressing at $\frac{1}{4}$ "; compresses to seal up to a $\frac{1}{16}$ " gap
- Available with perforations for Behavioral Health applications. Substitute "P" in place of "S" to order this option.



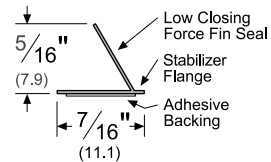
S44

AVAILABLE FINISHES: **BL, C, D, GR, W**

AVAILABLE LENGTHS: **17', 18', 20', 21', 25', 30', 204', 510'**

ANSI: **ROE154, ROE155**

- Designed for tighter frames.
- Demonstrates extremely low closing force.
- Seal begins compressing at $\frac{5}{16}$ "; compresses to seal up to a $\frac{1}{16}$ " gap
- Available with perforations for Behavioral Health applications. Substitute "P" in place of "S" to order this option.



NOTE: Products shown in this section may not be drawn to scale.

AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
Adhesive Gasketing Colors: **BL** (Black) **C** (Clear) **D** (Dark Brown) **GR** (Light Gray) **TAN** (Tan) **W** (White)

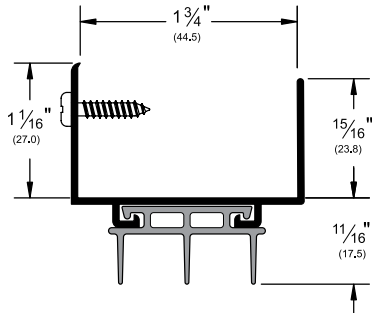
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Door Shoes (Cont.)

2173_V

AVAILABLE FINISHES: **A, BDG, D, G, PW**
 AVAILABLE LENGTHS: **36", 48"**
 REPLACEMENT INSERT: **EV94 (BL)**
 ANSI: **R3D414, R3D415**

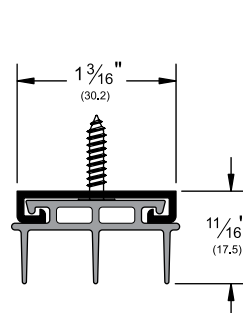


Also available with unnotched insert:
 2173_V36UN
 2173_V48UN



2343_V

AVAILABLE FINISHES: **A, D, G**
 AVAILABLE LENGTHS: **36", 48"**
 REPLACEMENT INSERT: **EV94 (BL)**
 ANSI: **R3D414, R3D415**

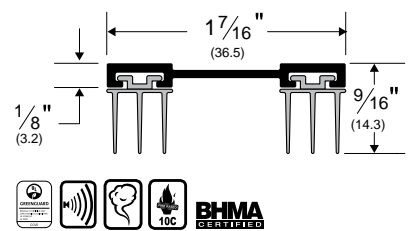


Also available with unnotched insert:
 2343_V36UN
 2343_V48UN



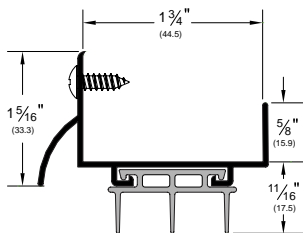
3692_PK773

AVAILABLE FINISHES: **A**
 AVAILABLE LENGTHS: **36", 48"**
 REPLACEMENT INSERT: **PK773 (BL, GR)**
 ANSI: **R3G414, R3G415**



2163_V

AVAILABLE FINISHES: **A, D, G**
 AVAILABLE LENGTHS: **36", 48"**
 REPLACEMENT INSERT: **EV94 (BL)**
 ANSI: **R3D514, R3D515**

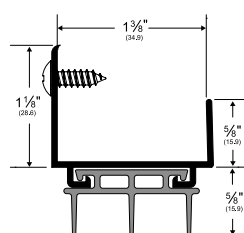


Also available with unnotched insert:
 2163_V36UN
 2163_V48UN



2203_V

AVAILABLE FINISHES: **A, D, G**
 AVAILABLE LENGTHS: **36", 48"**
 REPLACEMENT INSERT: **EV94 (BL)**
 ANSI: **R3D414, R3D415**

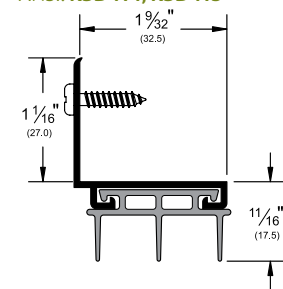


Also available with unnotched insert:
 2203_V36UN
 2203_V48UN



2113_V

AVAILABLE FINISHES: **A, D, G**
 AVAILABLE LENGTHS: **36", 48"**
 REPLACEMENT INSERT: **EV94 (BL)**
 ANSI: **R3D414, R3D415**

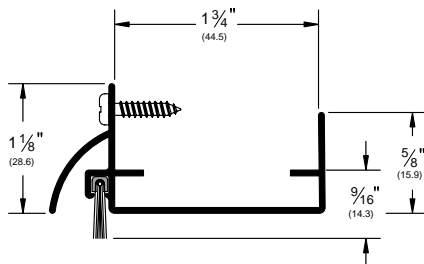


Also available with unnotched insert:
 2113_V36UN
 2113_V48UN



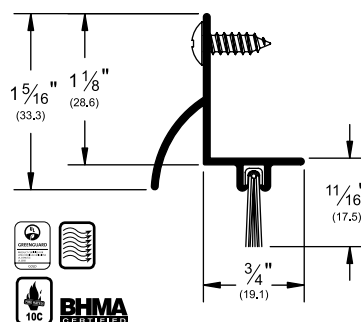
223_NB

AVAILABLE FINISHES: **A, D, G**
 REPLACEMENT INSERT: **P516041 (BL, GR)**
 ANSI: **R3A514, R3A515**



2230_NB

AVAILABLE FINISHES: **A, D, G**
 REPLACEMENT INSERT: **P516062 (BL, GR, W)**
 ANSI: **R3A514, R3A515**



NOTE: Products shown in this section may not be drawn to scale.

AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
A (Mill Finish Aluminum) **BDG** (Bright Dip Gold Anodized) **D** (Dark Bronze Anodized) **G** (Gold Anodized)
PW (Painted White)

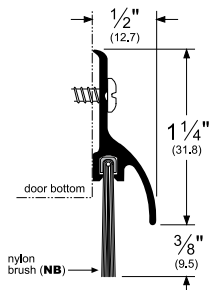
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Door Bottom Sweeps (Cont.)

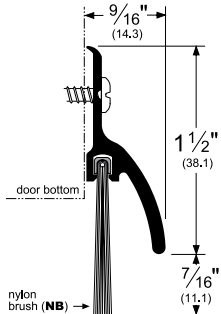
3452_NB

AVAILABLE FINISHES:
BDG, C, D, G, PW, SN
REPLACEMENT INSERT:
P14075 (BL, GR)
ANSI: **R3A534**



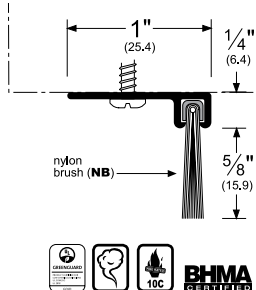
345_NB

AVAILABLE FINISHES:
A, BDG, D, G, PW
REPLACEMENT INSERT:
P14100 (BL, GR)
ANSI: **R3A534**



90062_NB

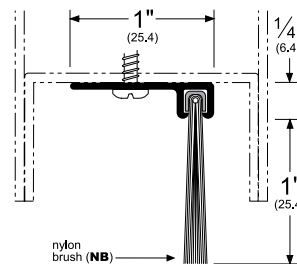
AVAILABLE FINISHES:
C, D, G
REPLACEMENT INSERT:
P516062 (BL, GR, W)
ANSI: **R3A414**



90100_NB

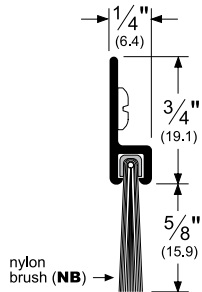
AVAILABLE FINISHES:
C, D, G
REPLACEMENT INSERT:
P516100 (BL, GR, W)
ANSI: **R3A414**

For hollow metal doors
with inverted channel



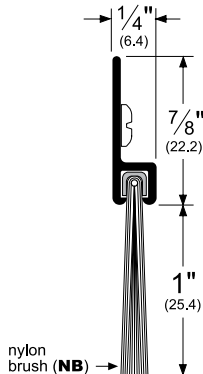
18061_NB

AVAILABLE FINISHES:
C, D, G, SN
REPLACEMENT INSERT:
P51062 (BL, GR, W)
ANSI: **R3A434**



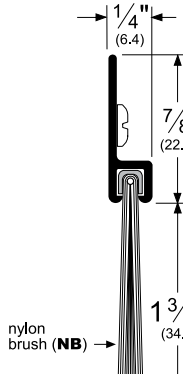
18100_NB

AVAILABLE FINISHES:
C, D, G, PW
REPLACEMENT INSERT:
P38100 (BL, GR)
ANSI: **R3A434**



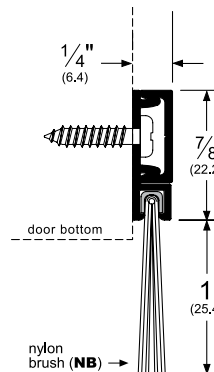
18137_NB

AVAILABLE FINISHES:
C, D, G, PW
REPLACEMENT INSERT:
P38137 (BL, GR)
ANSI: **R3A434**



293100_NB

AVAILABLE FINISHES:
C, D, G
REPLACEMENT INSERT:
P516100 (BL, GR)



NOTE: Products shown in this section may not be drawn to scale.

AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
A (Mill Finish Aluminum) **BDG** (Bright Dip Gold Anodized) **C** (Clear Anodized) **D** (Dark Bronze Anodized)
G (Gold Anodized) **PD** (Painted Dark Bronze) **SN** (Satin Nickel Anodized)

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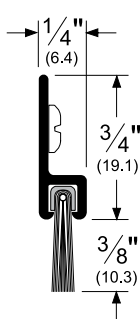
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180° Aluminum Retainers (Cont.)

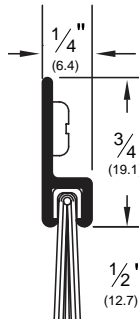
18041_NB

AVAILABLE FINISHES:
C, D, G, PW, SN
REPLACEMENT INSERT:
P516041 (BL, GR)
ANSI: **R3A134, R3A164, R3A734**



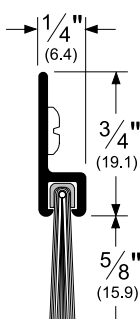
18050_NB

AVAILABLE FINISHES:
C, D, G, PW, SN
REPLACEMENT INSERT:
P516050 (BL, GR)
ANSI: **R3A434, R3A734**



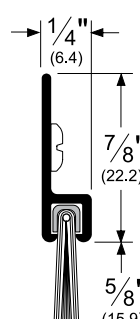
18061_NB

AVAILABLE FINISHES:
C, D, G, PW, SN
REPLACEMENT INSERT:
P516062 (BL, GR, W)
ANSI: **R3A434, R3A734**



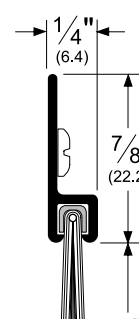
18062_NB

AVAILABLE FINISHES:
C, D, G, PW
REPLACEMENT INSERT:
P38062 (BL, GR, W)
ANSI: **R3A434**



18100_NB

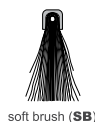
AVAILABLE FINISHES:
C, D, G, PW
REPLACEMENT INSERT:
P38100 (BL, GR)
ANSI: **R3A434**



Alternate Inserts For 18041

18041_SB

AVAILABLE FINISHES: **C, D, G, SN**
REPLACEMENT INSERT: **P3 (BL, GR)**



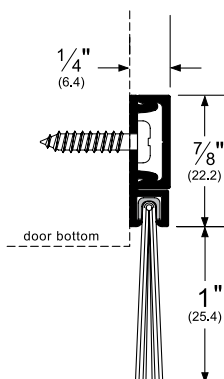
soft brush (SB)

180° Concealed Fastener Retainers

- Aluminum snap cover conceals mounting screws to provide a clean aesthetic appearance
- Replacement snap cover is item _29316; when ordering, identify finish and length
- Cover snaps securely into place to deter vandalism

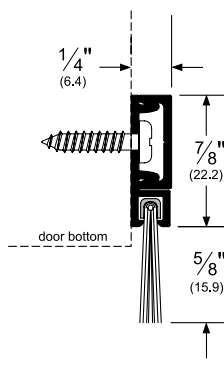
293100_NB

AVAILABLE FINISHES:
C, D
REPLACEMENT INSERT:
P516100 (BL, GR, W)
ANSI: **R3A434**



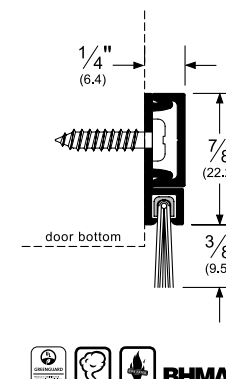
29326_NB

AVAILABLE FINISHES:
C, D, G
REPLACEMENT INSERT:
P516062 (BL, GR, W)
ANSI: **R3A434**



29324_NB

AVAILABLE FINISHES:
C, D, G
REPLACEMENT INSERT:
P516041 (BL, GR)
ANSI: **R3A434**



Alternate Insert For 29324

29324_SB

AVAILABLE FINISHES: **C, D**
REPLACEMENT INSERT: **P3 (BL, GR)**



soft brush (SB)

NOTE: Products shown in this section may not be drawn to scale.

AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
C(Clear Anodized) **D**(Dark Bronze Anodized) **G**(Gold Anodized) **PW**(Painted White) **SN**(Satin Nickel Anodized)
Special finishes available upon request

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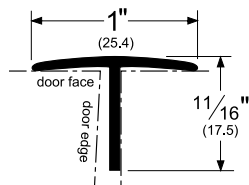
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"T" and Overlapping Astragals

359_

AVAILABLE FINISHES:
A, BDG, D

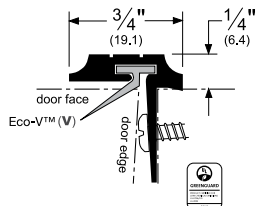
- Supplied with weatherstrip nails for installation



356_V

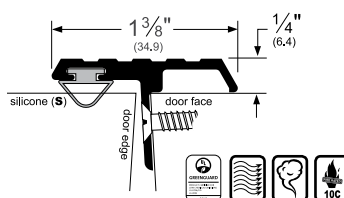
AVAILABLE FINISHES:
A, BDG, D, PW, SN
REPLACEMENT INSERT:
EV17 (BL, GR, W)

- Countersink drilling with countersunk flathead screws also available upon request at no extra charge



355_S

AVAILABLE FINISHES:
B, BDG, C, D, G, PW, SN
REPLACEMENT INSERT:
S4 (BL, GR)



Alternate Inserts For 355_V

355_V

AVAILABLE FINISHES:
B, BDG, C, D, G, PW, SN
REPLACEMENT INSERT:
EV7 (BL, GR, W)



355_P

AVAILABLE FINISHES:
B, BDG, C, D, G, PW, SN
REPLACEMENT INSERT:
P2 (BL, GR)

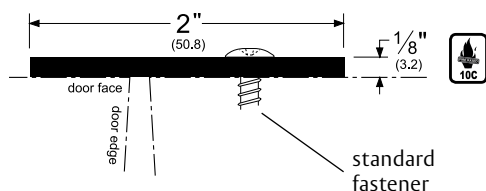


357_ 357_ND

AVAILABLE FINISHES:
C, D, G, SP, SS (#4 Finish & #4 Edge)

11 GAUGE

- "ND" denotes "no drill" (unless specified "ND", astragals are drilled)
- Standard fastener is #10 x 1" Truss Head SMS
- Lead-line option available

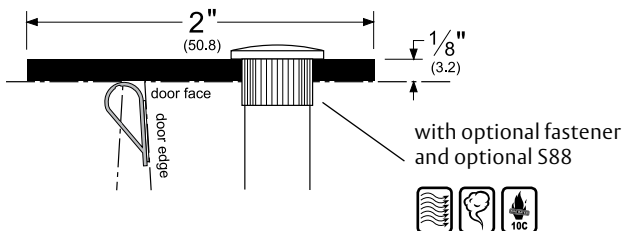


357_ with S88

AVAILABLE FINISHES:
SP, SS (#4 Finish & #4 Edge)

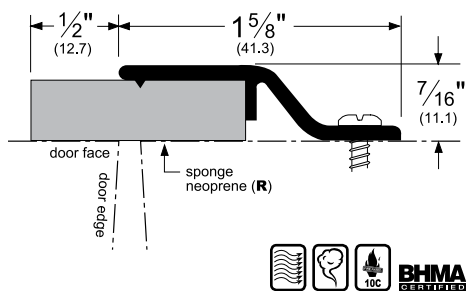
11 GAUGE

- Standard fastener is #10 x 1" Truss Head SMS
- 1/4" - 20 machine screws and thru-bolts must be ordered separately at additional cost
- S88 seal must be ordered separately at an additional cost, if required
- If specifications state that an astragal is required to satisfy a fire and / or smoke opening, then a thru-bolted 357SP or SS in conjunction with S88 seal is the only configuration that can be used.



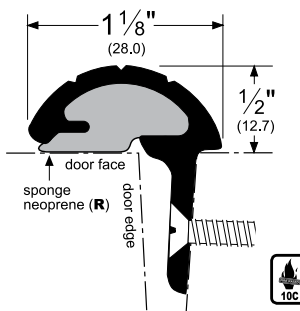
375_R

AVAILABLE FINISHES: **B, C, D, G**
REPLACEMENT INSERT: **R4 (BL)**
ANSI: **R3C634, R3C635**



352_R

AVAILABLE FINISHES: **C, D, G**
REPLACEMENT INSERT: **R8 (BL)**
For reverse bevel doors



AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
A (Mill Finish Aluminum) **B** (Mill Finish Extruded Bronze [Brass]) **BDG** (Bright Dip Gold Anodized) **C** (Clear Anodized)
D (Dark Bronze Anodized) **G** (Gold Anodized) **PW** (Painted White) **SN** (Satin Nickel Anodized) **SP** (Galvannealed Steel)
SS (See Individual Part) Special finishes available upon request

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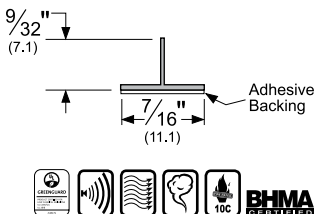
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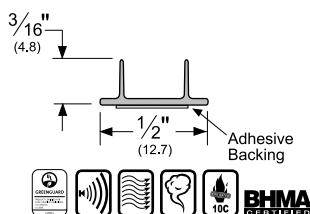
Adhesive Astragal/Meeting Stile Seals

- The **S771** and **S772** astragal/meeting stile seals can be installed on virtually any pair of doors where sound attenuation is required. These products seal the opening to prevent heat loss, retard the passage of smoke, and act as a weatherization product
- Excellent resistance to compression set, particularly at elevated temperatures and for extended periods of time
- Stays flexible between -58°F and 450°F with very high resistance to flex fatigue
- Maintains a low closing force
- Easy installation requires no mechanical fasteners; can be cut to size in the field

S771_
AVAILABLE FINISHES: **BL, C, D, GR, W**
AVAILABLE LENGTHS: **7', 8', 9', 10'**
ANSI: **ROE754, ROE755**

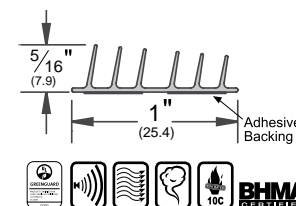


S772_
AVAILABLE FINISHES: **BL, C, D, GR, W**
AVAILABLE LENGTHS: **7', 8', 9', 10'**
ANSI: **ROE754, ROE755**



S771x6_
AVAILABLE FINISHES: **BL, C**
AVAILABLE LENGTHS: **7', 8', 9', 10'**
ANSI: **ROE154, ROE155, ROE754, ROE755**

- Designed for hollow metal and wood meeting stile applications
- Seal begins compressing at $\frac{5}{16}$ " ; compresses to seal up to a $\frac{1}{16}$ " gap



Notes For All Adhesive Gasketing:

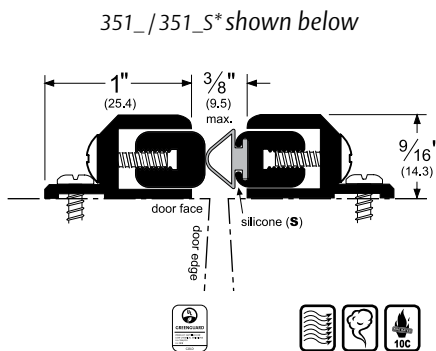
Storage and shelf life: All adhesive gaskets have a limited shelf life. This product must be installed within 6 months of purchase and must be stored between 50°F and 100°F. For further notes/details, please see Adhesive Gasketing section.

Adjustable Astragals

- Available in 84", 96" and 120" lengths
- When used as split astragals on double doors, two lengths must be ordered: one for each door

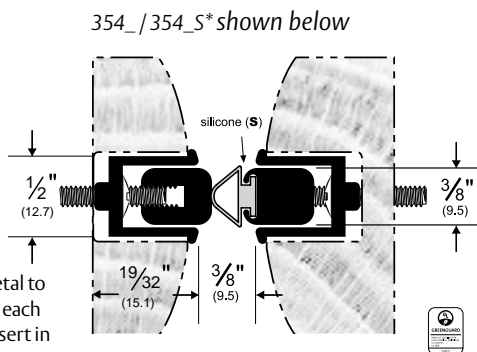
351_S
AVAILABLE FINISHES:
B, C, D, G
REPLACEMENT INSERT:
S4 (BL, GR)

- Surface applied
- For use with square-edge or bevel-edge doors



354_S
AVAILABLE FINISHES:
B, C, D, G
REPLACEMENT INSERT:
S4 (BL, GR)

- Fully mortised
- Designed for use with bullnose doors



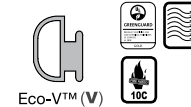
* If you require split astragals in a metal to gasket configuration, you must order each leaf separately with your choice of insert in the tables to the right

Alternate Inserts For 351

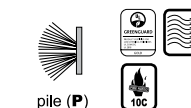
351_PK
AVAILABLE FINISHES:
B, C, D, G
REPLACEMENT INSERT:
PK4 (BL, GR)



351_V
AVAILABLE FINISHES:
B, C, D, G
REPLACEMENT INSERT:
EV41 (BL, GR, W)



351_P
AVAILABLE FINISHES:
B, C, D, G
REPLACEMENT INSERT:
P2 (BL, GR)



Alternate Inserts For 354

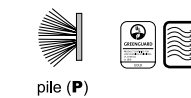
354_PK
AVAILABLE FINISHES:
B, C, D, G
REPLACEMENT INSERT:
PK4 (BL, GR)



354_V
AVAILABLE FINISHES:
B, C, D, G
REPLACEMENT INSERT:
EV41 (BL, GR, W)



354_P
AVAILABLE FINISHES:
B, C, D, G
REPLACEMENT INSERT:
P2 (BL, GR)

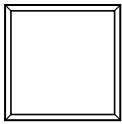


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AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
B (Mill Finish Extruded Bronze [Brass]) **C** (Clear Anodized) **D** (Dark Bronze Anodized) **G** (Gold Anodized)
Special finishes available upon request
Gasket colors: **BL** (Black) **C** (Clear) **D** (Dark) **GR** (Gray) **W** (White)

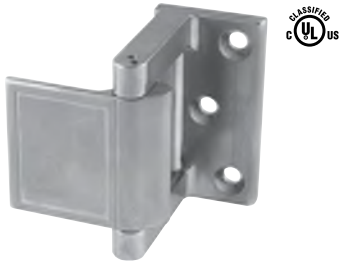
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Wall Guard No. 606

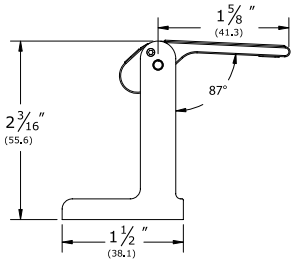
- Material:** Clear rubber
Other: Sold in sheets of 55
Features: Self-adhesive mounting

No.	Fastener	Size	Weight
606	Self-adhesive back	1" x 1"	0.4 lbs./55

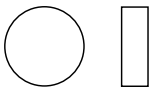


Privacy Door Latch No. PDL (formerly 607)

- Material:** Zinc die cast
Finishes: BRS, DBRS, STNN, CRM, DCRM, ORB
Features:
- ADA compliant
 - Enhanced in room privacy
 - Easy to install
 - For use with UL Classified fire doors for use with hollow metal steel composite type fire doors rated up to and including 3 hrs Wood composite type fire doors rated up to and including 1½ hrs and 20 minutes without hose stream



No.	Fastener	Size	Weight
PDL	#12 x 1¼" FH SMS	1½" x 2 ¹³ / ₁₆ "	0.75 lbs.



Door Silencer No. 608CA

- Material:** Clear rubber
Other: Sold in packages of 300
Features: Self-adhesive mounting

No.	Fastener	Size	Weight
608CA	¾" dia. x 1/8"	Metal or wood	0.2 lbs./300



Door Silencers No. 608, 609

- Material:** DuraFlex gray rubber
Other: Sold in packages of 100

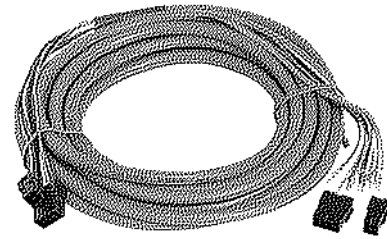
No.	Size	Frame Type	Weight	ANSI A156.16
608	½" dia. x 5/8"	Metal	1.3 lbs./500	L03011
609	¾" x ¾"	Wood	1.3 lbs./500	L03021

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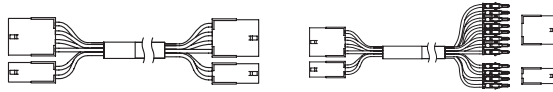
ElectroLynx® Retrofit Cables

If you are not ordering ASSA ABLOY Door Group doors with the ElectroLynx® cable pre-installed in the door, you must order an ElectroLynx® retrofit cable to go between ANY hardware and the hinge. This includes 3" cables to go from the hinge to an exit device and up to a 15' cable to go up and around a full lite metal door.



QC-C1500P Shown

Standard ElectroLynx® Retrofit Cable Sizes



Actual Cable Length	12 Conductor and Molex both ends	12 Conductor and Molex one end, pinned one end	Typical Application
3"	QC-C003	QC-C003P	
6"	QC-C006	QC-C006P	Between hinge and the end of an exit device.
12"	QC-C012	QC-C012P	
26"	QC-C200	QC-C200P	
32"	QC-C206	QC-C206P	
38"	QC-C300	QC-C300P	Between hinge and through the door to the lockset or exit device trim.
44"	QC-C306	QC-C306P	
50"	QC-C400	QC-C400P	
15' 2"	QC-C1500	QC-C1500P	From the hinge location, up the jamb to above the ceiling, or up and around full lite or half lite metal door.
25'	-	QC-C2500P	
30'	-	QC-C3000P	

Custom lengths available.

ASSA ABLOY
Opening Solutions

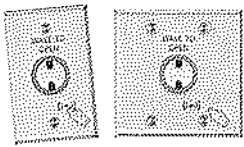
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Check the web site for the up-to-date catalog

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WAVE-TO-OPEN SWITCHES

Available With	700, 704
6300 Series	✓
6000 Series	✓
5800 Series	✓
5700 Series	✓
5600 Series	✓
5500 Series	✓



700

Wave-to-Open Wall Switch

- Single gang and double gang packaged together
- Sensor requires movement for activation
- Variable relay – hold time from 0 – 35 seconds
- Range 0" to 4"
- Dimensions:
3" W x 4-3/4" H (single);
4-1/2" W x 4-1/2" H (double)



704

Narrow Wave-to-Open Wall Switch

- Narrow gang
- Sensor requires movement for activation
- Variable relay - hold time from 0-35 seconds
- Range 0" to 4"
- Durable stainless steel body holds up in moist environments

PUSH PLATE, SWITCH POST, MOTION SENSOR

Available With	638, 639, 530, 500, 663
6300 Series	✓
6000 Series	✓
5700 Series	✓
5500 Series	✓



638

Low Profile Push Plate

- 36" x 6" activation zone
- 1" low profile depth
- Stainless steel face plate
- Adapts to either wireless or hard wired installations
- 638 - Wireless
- 639 - Hard wired



500

Switch Post

- 4" x 6" x 40" x 3/16" wall thickness
- 9 volt battery
- RF temperature range: -4° F to 122° F
- 689 (aluminum) or 690 (dark bronze) finishes
- Standard formed plastic cap
- Surface mounted (above ground)
- 530 - radio frequency transmitter
- 500 - hard wired switch
- 530POST - post only; switch not included

Motion Sensor

- 4-3/4" x 3-3/16" x 2" projection
- Unidirectional
- Black cover
- SPDT relay
- Adjustable angle pattern
- 24 VDC input
- Must not be placed where motion of door can be sensed



663*

Note:

- Metal enclosures can reduce signal strength and cause an intermittent or reduced signal reception when using a radio frequency transmitter. To ensure proper function, do not use metal conduit housing.
- Bright light like direct sunlight can interfere with the Wave To Open signal.

* Use of motion sensor must be approved by local authority having jurisdiction.



No. 626



No. 622

190° Door Viewer No. 622, 622VC, 626

Material: Brass

Finishes: Antique bronze (ANT), brass (BRS), bright chrome (CRM), dull chrome (DCRM), satin nickel (STNN)

Other: Installation – drill $\frac{9}{16}$ " hole

Features: No. 626 features a privacy cover to prevent visual intrusion from outside of the room

No.	Inside Cover	For Doors	Weight	ANSI A156.16
622	No	$1\frac{3}{8}$ " to $2\frac{1}{8}$ "	0.1 lbs.	L03221, L03171
622VC	Cover only		0.1 lbs./10	
626	Yes	$1\frac{3}{8}$ " to $2\frac{1}{8}$ "	0.1 lbs.	L03221, L03171



No. 627, 628, 629

190° Door Viewer with Heavy Duty Privacy Cover No. 627, 628, 629

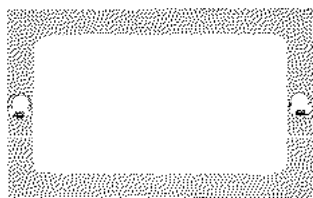
Material: Brass

Finishes: Bright chrome (CRM)

Other: Installation – drill $\frac{9}{16}$ " hole. UL fire rated for 1½ hours

Features: Heavy duty privacy cover to prevent visual intrusion from outside of the room

No.	For Doors	Weight	ANSI A156.16
627	$1\frac{3}{8}$ " to $2\frac{1}{8}$ "	0.1 lbs.	L03221, L03171
628	$\frac{9}{16}$ " to $1\frac{3}{16}$ "	0.1 lbs.	L03221, L03171
629	$1\frac{5}{16}$ " to $1\frac{1}{4}$ "	0.1 lbs.	L03221, L03171



Card Holder No. 651

Material: Cast brass

Finishes: Available in standard architectural finishes (see page 9)

Fastener: 2 ea. #8 x $\frac{3}{4}$ " OH SMS

No.	Size	Card Size	Opening	Weight
651	$2\frac{1}{2}$ " x $4\frac{1}{4}$ "	2" x $3\frac{1}{2}$ "	$1\frac{3}{4}$ " x $3\frac{1}{4}$ "	0.2 lbs.

THIS DOOR TO REMAIN UNLOCKED DURING BUSINESS HOURS

No. 660

THIS DOOR TO REMAIN UNLOCKED WHILE BUILDING IS OCCUPIED

No. 661

THESE DOORS TO REMAIN UNLOCKED WHILE BUILDING IS OCCUPIED

No. 662-RKW

Decal No. 660, 661, 662-RKW

Material: Silver foil

Fastener: Self-adhesive mounting

Other: Black lettering

Size: $1\frac{1}{2}$ " x $2\frac{6}{12}$ "

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MS4043

Cylinder Guard



MS4043 Cylinder Guard is a hardened-steel ring to protect cylinder from vandalism.

Function

The standard mortise cylinder is made of brass. It is literally a soft spot in narrow stile door security. Using special pliers, a pipe wrench or other leverage device, a burglar can tear the cylinder out of the door, leaving an opening through which the deadlock may be operated.

The MS4043 Cylinder Guard offers a three-way defense against this problem:

1. The outer shield ring is fully beveled to offer poor purchase for either prying or twisting.
2. The ring is hardened steel so that the combination of shape and hardness make it virtually impossible to grip, even with sharpened tools.
3. In the event that a prying tool such as a cold chisel is driven into the stile behind the shield ring, the would-be burglar is obliged to pull a heavy steel plate through a round hole in the 1/8" metal door stile. This degree of leverage is far beyond that available with most hand tools.

Features

Security Ring

Made of hardened-steel. Free-swiveling when properly installed.

Retainer Ring

Hardened-steel, plated for corrosion resistance. Permits security ring to swivel.

Trim Finish

Powder coat 119 to match 335
Black anodized, 121 to match
313 Dark bronze anodized, 130
to match 628 Clear anodized

Standard Package

Individually packaged with spacers for flush fitting in thin stile walls. Cylinders available separately.

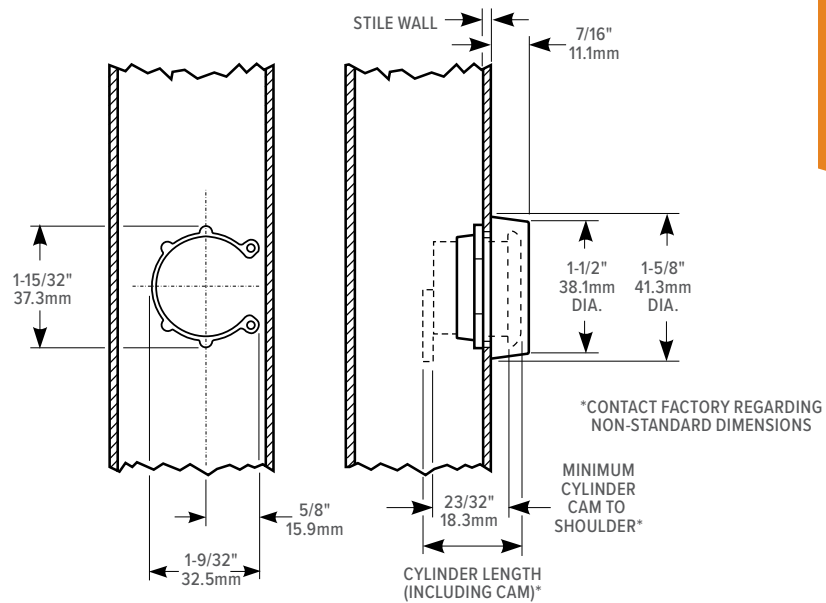
Shipping Weight

1/8 lb. [0.06 kg]

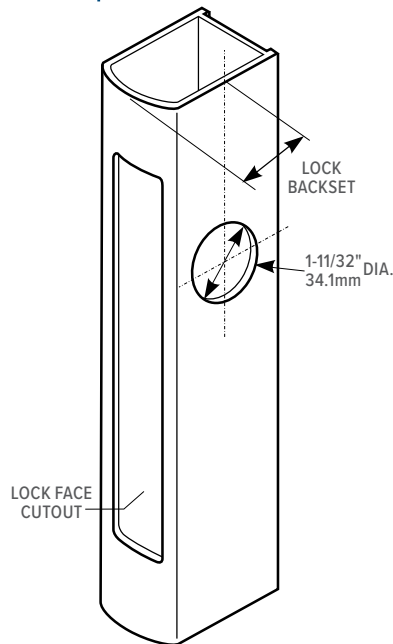
Options

- MS4043 Cylinder Guard fits a standard 1/8" stile wall. For 1/4" thick stile walls, specify MS4043-01.

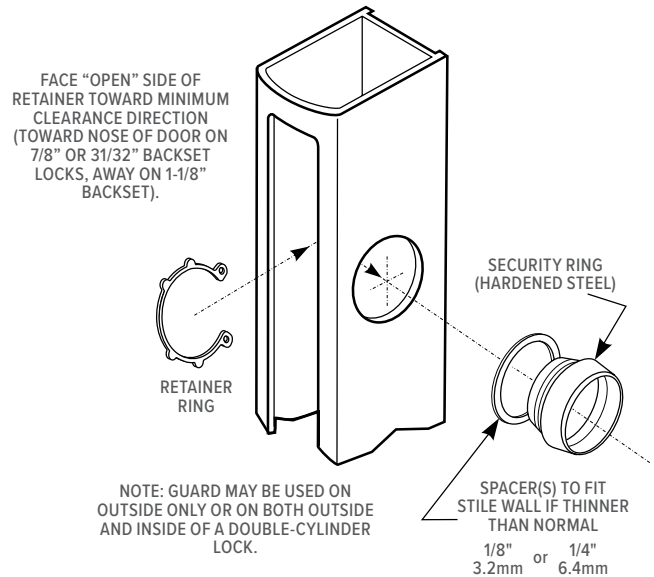
Dimensions



Stile Preparation



Installation



How to Order & Compatible Products

MS4043 Cylinder Guard Specify quantity and the following information. Order related products separately.

MODEL	STILE WALL & CYLINDER		FINISH
MS4043	-01		-130
	Stile Wall	Cylinder	119 To match 335 Black Anodized
	00 1/8"	5 or 6 pin	121 To match 313 Dark Bronze Anodized
	01 1/4"	5 or 6 pin	130 To match 628 Clear Anodized
	02 1/8" (3.2mm)	1-5/16" to 1-7/16" long	

COMPATIBLE

DEADLOCKS	DEADLATCHES	FLUSHLOCKS	EXIT DEVICES
1830, MS1837, MS1850S, MS1850S-050, MS1850SN, MS1850SN-050, MS1861, 1875, MS+1890, MS1950, MS1950-050, 2190, 2290 Series Deadlocks	4300 Electrified Deadlatches, 4510, 4530, 4900, 4920AN Series Deadlatches 4781 Two point Deadlatch	1870, 1870HM Series Cylinder-Operated Flushbolts	8300, 8400 Mortise Exit Devices

4089

Exit Indicator

4089 Exit Indicator provides exit door notification for various Adams Rite deadlocks.

Function

Provides unmistakable notification of lock status. Under many local building safety codes this allows the use of a security deadlock instead of exit devices, in certain occupancies. It includes two permanent adhesive header signs: "THIS DOOR TO REMAIN UNLOCKED DURING BUSINESS HOURS." (that wording is according to Uniform Building Code). The second sign for NFPA and other local codes reads: "THIS DOOR TO REMAIN UNLOCKED WHEN THE BUILDING IS OCCUPIED." Please consult local Authority Having Jurisdiction (AHJ) for more information.



Aluminium

Hollow
Metal

Wood

Features

Indicator

Words "LOCKED" in red letters or "OPEN" in green letters appear on white background when bolt is thrown or retracted respectively. Indicator is driven by lock bolt itself.

Materials

Indicator escutcheon is zinc alloy. Available in choice of powder coat 119 to match 335 Black anodized, 121 to match 313 Dark bronze anodized, and 130 to match 628 Clear anodized. Header sign is clear aluminum match with black letters.

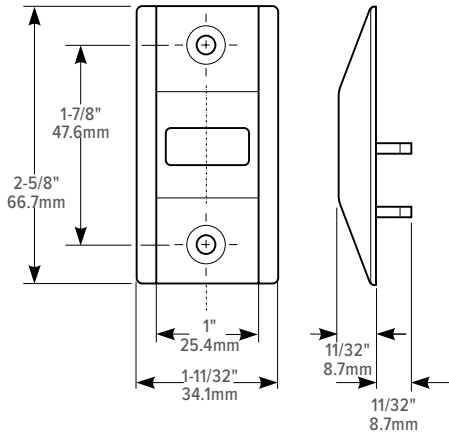
Shipping weight

1/2 lb [0.23 kg].

Options

- Standard unit fits 1-3/4" [44.5 mm] door. Specify for thicker doors up to 2-1/2" [63.5 mm].

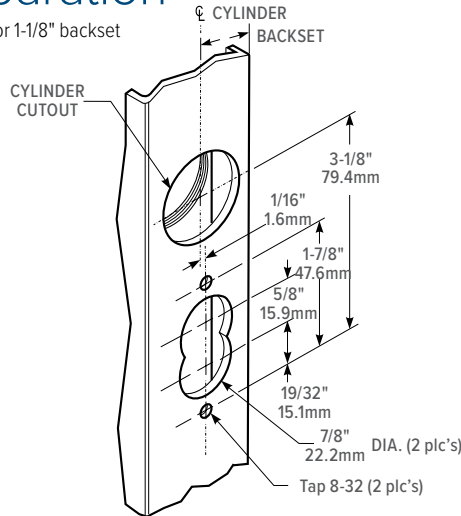
Dimensions



*This sign correct under Uniform Building Code. Also includes NFPA wording "This Door to remain unlocked when the building is occupied".

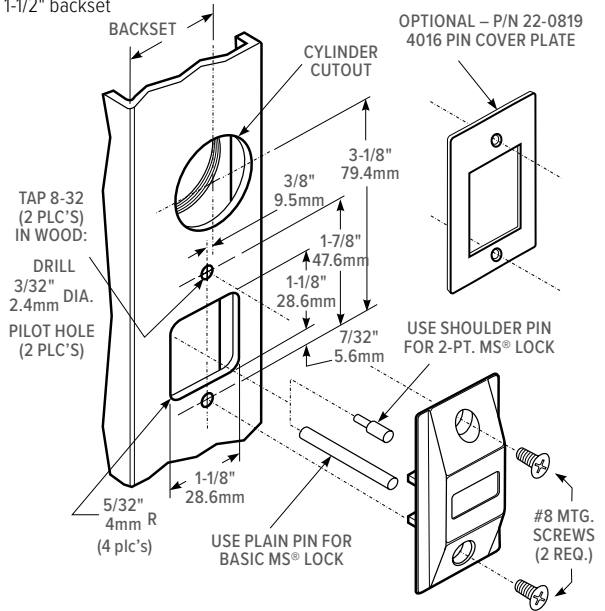
Aluminium Stile Preparation

For 31/32" or 1-1/8" backset



Wood & Hollow Metal Stile Preparation

For 1-1/2" backset



How to Order, Related & Compatible Products

4089 Exit Indicator: Specify quantity and the following information. Order related products separately.

MODEL	OPTIONS	FINISH
4089	-01	-130
	00 Standard 1-3/4" Door	119 To match 335 Black Anodized
	01 For Inverted Lock	121 To match 313 Dark Bronze Anodized
	20 For Doors up to 2-1/2"	130 To match 628 Clear Anodized

RELATED

When purchasing this product, please consider the following related products, available separately:

ACCESSORIES
91-0912 Adapter Plate, 22-0819 Cover Plate, 20-0255-IP Header Sign, 20-0256-IP IBC Header Sign

COMPATIBLE

DEADLOCKS	FLUSHLOCKS
MS1837, MS1850S, MS1850S-050, SCH1850S, MS1850SN, MS1850SN-050, SCH1850SN, MS+1890, MS1950, MS1950-050, Series Deadlocks	1870, 1870HM, 1877 Series Cylinder-Operated Flushbolts

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